AUGUST 1943

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TOOL & DIE JOURNAL

TOOLING AND PRODUCTION

TOOLS THAT
• CUT FASTER
• LAST LONGER

High Speed End Mills

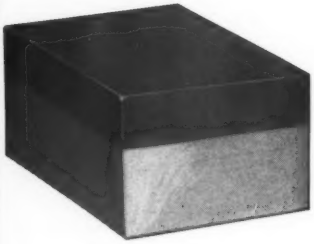
PUTNAM HI-SPEED
Continuous Pilot
COUNTERBORES

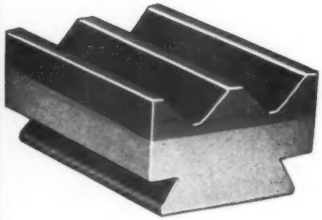
Counterbores that provide exceptional tool economy! Almost the entire tool can be utilized as the pilot extends without interruption through the entire fluted portion. As the cutter flutes are ground back due to wear, the pilot head can be cut off to any desired length. A perfect pilot head is always exposed. With effortless feeding, Putnam Continuous-Pilot Counterbores cut rapidly, smoothly and accurately . . . producing long spiralling chips rather than small metal particles. Write for full details.

ARMY E NAVY

PUTNAM TOOL COMPANY
2985 CHARLEVOIX AVE. • DETROIT 7, MICH.

NEW WAY TO CONSERVE HIGH SPEED STEEL





Special Bulletin contains full particulars and prices. Write for your copy of Bulletin TQ today.

Dovetail forming cutters made from FCC Electrically Welded Composite Steel Blanks ***(high speed steel cutting face; mild steel base)*** **save at least 50% of high speed steel. Besides, they offer other distinct advantages. Obvious among them are:—**

1. **Non-hardenable, tough base minimizes tendency to crack and break out at sharp dovetail corners and screw holes during heat treating or when working.**

2. **Easier to drill and tap screw holes and machine dovetails in mild steel base; this work may be done** ***after*** **hardening if desired.**

3. **More prompt delivery because of reduced amount of high speed steel.**

4. **Inseparable bond between cutting face and base assured by special technique of electric welding.**

5. ***Marked saving of strategically important tungsten.***

QUALITY FCC SERVICE

THE FORGING and CASTING CORPORATION

FERNDALE (DETROIT) MICHIGAN

HARDINGE

SPECIFICATIONS:
1" collet capacity, 6" step chuck capacity, 5" jaw chuck capacity, 9" swing, eight spindle speeds up to 4000 R.P.M.

HIGH SPEED PRECISION
SECOND OPERATION MACHINE

• A common error of production departments has been the purchase of large, expensive machines, capable of performing many operations — and then confine them to one use — second operation work. Immediately, the purpose for which the machine was purchased — many operations — is defeated.

Now the trend is to Hardinge — designed only for second operation work. The initial low cost, the versatility and unusual capacity, without the set-up complications involved with large machines, created an ever-increasing demand for this machine.

The double tool cross slide and turret take standard tooling. The six-position tilted turret has an automatic indexing and locking head with six independent travel stops.

PERFORMANCE HAS ESTABLISHED LEADERSHIP FOR

HARDINGE
ELMIRA, N.Y.

THE TOOL & DIE JOURNAL

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Contents

Vol. IX, No. 5 August, 1943

Editorial · George J. Huebner	85
Present Status of Powder Metallurgy	87
Cold Drawing Steel Cartridge Cases William Halker	91
Designing Carbide Tools	94
Training for Victory Broaching Technique · Part 2	99
Modern Designs for Drilling Jigs and Tapping Fixtures · C. W. Hinman	115
Inspection Technique for the Small Plant K. F. Kirchhofer	119
Electronics in Industry · C. J. Madsen	121
Progress on Parade	122
Industrial Digest	125
Industrial Plastics · Gordon B. Thayer, Technical Consultant	129
Plastics Models Aid Product Development Carl Stricker	130
Molding Screw Threads in Plastics	131
Publication Previews	146
Shop Aids	174
Index to Advertisers	239

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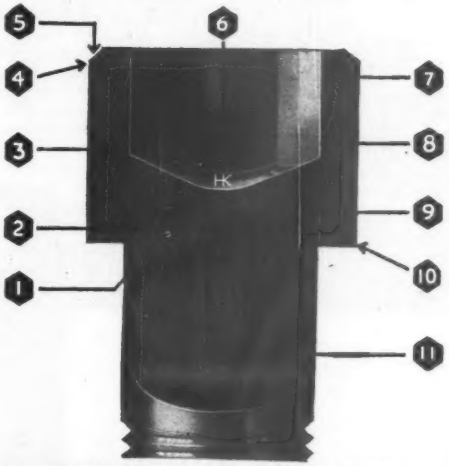
Acceptance under the Act of June 5, 1934, authorized October 22, 1942

That EXTRA something!

Completely Cold Forged

by HOLO-KROME



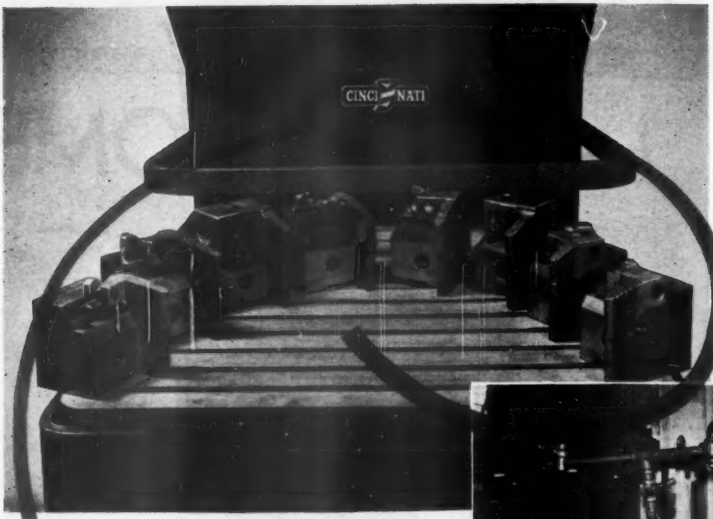
UNRETOUCHED PHOTO ETCHED CUTAWAY
HOLO-KROME SOCKET HEAD CAP SCREW

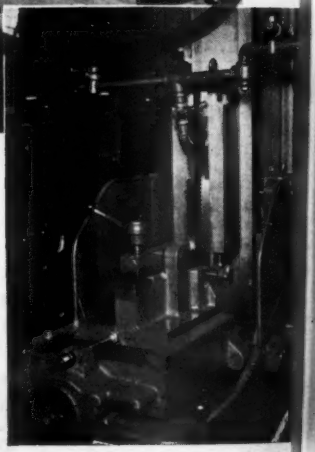
THE 11 FEATURES checked above show a few of the many "extra" qualities made possible by the patented Completely Cold Forging method — exclusively HOLO-KROME. Our Catalog explains in detail. Have you a copy?

HOLO-KROME FIBRO FORGED
TRADE MARK
SOCKET SCREWS
the results of a superior method patented, used solely by Holo-Krome in the manufacture of these precision made Completely Cold Forged Screws.

THE HOLO-KROME SCREW CORP. HARTFORD, CONN., U. S. A.

DO YOU KNOW ABOUT T





Right: Close-up of the CINCINNATI Single Ram Hydro-Broach tooled up for the above parts. Engineering specifications may be obtained by writing for catalog No. M-886.

TOOL ROOM AND MANUFACTURING MILLING MACHINES . . SURFACE BROACHING MACHINES . . CUTTER SHARPENING

THE OPPORTUNITIES

Open to Big Families?

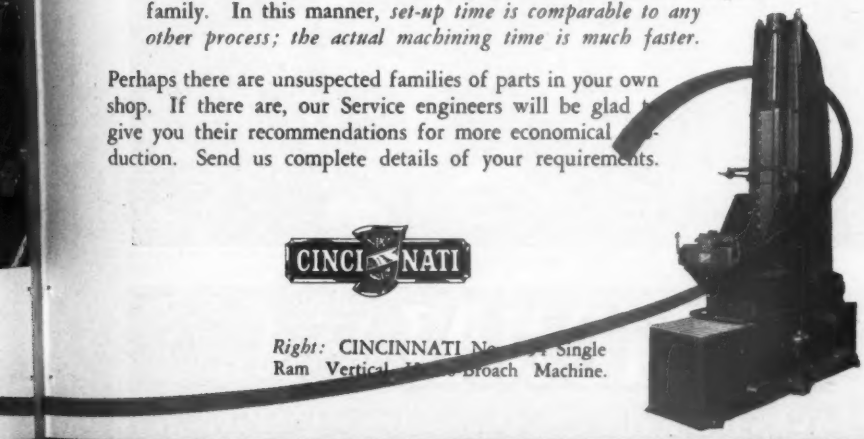
MANY of us know from first hand experience the advantages and disadvantages, the trials and tribulations of large families. In the machine shop, every consideration of the large family (of parts) is on the plus side and with the proper scheduling, the various members can be grouped and produced much faster than individually.

The eight parts in the above illustration are typical of family grouping for more rapid and more precise production. They are various sizes of copper terminal studs used in electrical control panels on shipboard. All of them require a machining operation on the sides.

Our Engineering Service Department, experienced in the production of families of parts manufactured in small quantities, devised equipment for machining them by the rapid broaching process on a CINCINNATI No. 5-54 Single Ram Vertical Hydro-Broach. Eight holding blocks are interchangeable in one fixture, and one set of broaching inserts handles the complete family. In this manner, *set-up time is comparable to any other process; the actual machining time is much faster.*

Perhaps there are unsuspected families of parts in your own shop. If there are, our Service engineers will be glad to give you their recommendations for more economical production. Send us complete details of your requirements.

CINCINNATI



Right: CINCINNATI No. [illegible] Single Ram Vertical [illegible] Broach Machine.

CINCINNATI GRINDERS INCORPORATED

MACHINES . . . CENTERTYPE GRINDING MACHINES . . . CENTERLESS GRINDING MACHINES . . . CENTERLESS LAPPING MACHINES

WEAPONS OF CONSTRUCTION!

The craftsmen making National cutting tools today know that they are making more than tools. They know they are making weapons—the weapons with which weapons are made.

In your hands these tools deserve the same care and attention that a soldier gives his rifle. Keep them fighting by keeping them working. Keep them working by keeping them sharp.

NATIONAL

TWIST DRILL AND TOOL COMPANY

No Need to look for LEVEL spots with this

"Empco JACK"

HERE'S HOW YOU CAN SET-UP YOUR MACHINES ON YOUR OLD FLOORS!

Why waste time trying to find a level spot to relocate your equipment? With this self-aligning EMPCO JACK you can "set-up" anywhere more quickly and accurately than ever before.

This new EMPCO Leveling Jack consists of only three parts: The upper and lower castings and the adjusting screw. The two castings are so fitted as to permit sufficient "float" for self alignment. This feature presents a full bearing and maximum support either on an even or irregular floor, hence with EMPCO Jacks there is *no need of level spots for machine locations.*

Quick Two-Way Adjustment

EMPCO Jacks greatly simplify entire operation of setting up and maintaining equipment level: Rest base on a set of No. 1, 2 or 3 Jacks according to the weight. Apply a wrench to the "hex" head of the adjusting screw and a micrometer-like adjustment is obtained *either up or down*, until your spirit level reads "zero".

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Write for sizes and prices today.

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TOOLS
TO SPEED UP PRODUCTION
Tools that increase the machine's efficiency by combining two or more operations in one . . .
Tools that operate with such precision that many final finishing operations may be simplified or made entirely unnecessary . .
Tools of such durability and hardness that they permit many additional cuts without regrinding . .
Those are the tools produced by Pipe Machinery folks—milling cutters, hobs, special tools.
The PM Diamond Emblem is your assurance of accuracy, precision and long life.
For tools that both maintain quality of work and increase production, phone, wire or write—for catalog, quotations and delivery dates.
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The PIPE MACHINERY COMPANY Cleveland, O.

Dual-Spiral Blades Ream
PRECISION HOLES

Whether you work with bronze, aluminum, iron, steel, nickel alloys or all of them, Lempco-Evans Hi-Speed Steel Reamers are equally superior. Patented Dual-Spiral blades finish holes to tolerances of .0001″. Straight line expansion from .050″ to .080″ maintains size and keen cutting edge, as well as affords many more resharpenings.* Right and left removable spiral blades, shearing in opposite directions simultaneously, ream over keyways, oil grooves, slots, or split bushings smoothly and rapidly, producing chrome-like finish.

Only the

LEMPCO-EVANS DUAL-SPIRAL REAMER HAS ALL THESE FEATURES:

- Finishes holes to tolerances of .0001″
- Makes Clean Holes
- Eliminates Honing
- Extension Pilots for Alignment Jobs
- Locked-in Patented Blades Prevent Chatter.
- Produces FULL Bearing Surface
- BLADES ARE HIGH SPEED STEEL, heat-treated, and hard chrome-plated
- Expansion from .050″ to .080″

*(Sizes under 11/16″ slightly less)

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BEDFORD, OHIO

You get accurate, dependable results and

SAVE A LOT OF MONEY

— with the Delta Carbide Tool Grinder

This low-cost grinder runs absolutely true, free from vibration, for fine grinding of carbide tipped tools

Manufactured by modern precision methods in a modern plant, this sturdy, vibrationless Delta Carbide Tool Grinder is so well-built, so accurately machined that you can depend on especially fine results.

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Widely used in war plants, this good-looking, modern machine has made a record for itself wherever it has been installed. Get credit for discovering the low-cost Delta way in *your* plant. Investigate! Send for the new Delta catalog giving full details.

M-2CC

TEAR OUT AND MAIL THIS COUPON TODAY

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Please send me your new catalog giving full details on the Delta Carbide Tool Grinder and your full line of low-cost machine tools.

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Company.....

Address.....

City.....(.....) State.....
Zone

DELTA
MILWAUKEE
Machine Tools

ARMY E NAVY

THE ARMY-NAVY "E" — *awarded for excellence in the production of machine tools vitally needed in the war effort.*

REVERSING SWITCH

Conveniently located at front of grinder. Six-pole type, completely wired into the unit. Opens both sides of line.

Citation of Honor

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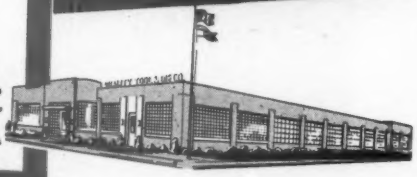
The men and women of the Quality Tool & Die Company, of Indianapolis, have received the coveted Army-Navy "E" Award in recognition of outstanding accomplishments in the production of precision inspection gages.

We are indeed proud of this, the highest honor which can be paid to civilians for their contribution to Victory. The "E" pins, which we wear, will serve as an inspiration to even greater achievements in the days ahead.

I wish to take this opportunity to publicly express my deep appreciation to all the loyal workers whose devotion to duty and constant striving for improvement has brought this award to the Quality Tool & Die Company.

Ray W. Rice.
General Manager

Quality
TOOL & DIE CO.
Manufacturers of "Quality Products"
INDIANAPOLIS, INDIANA



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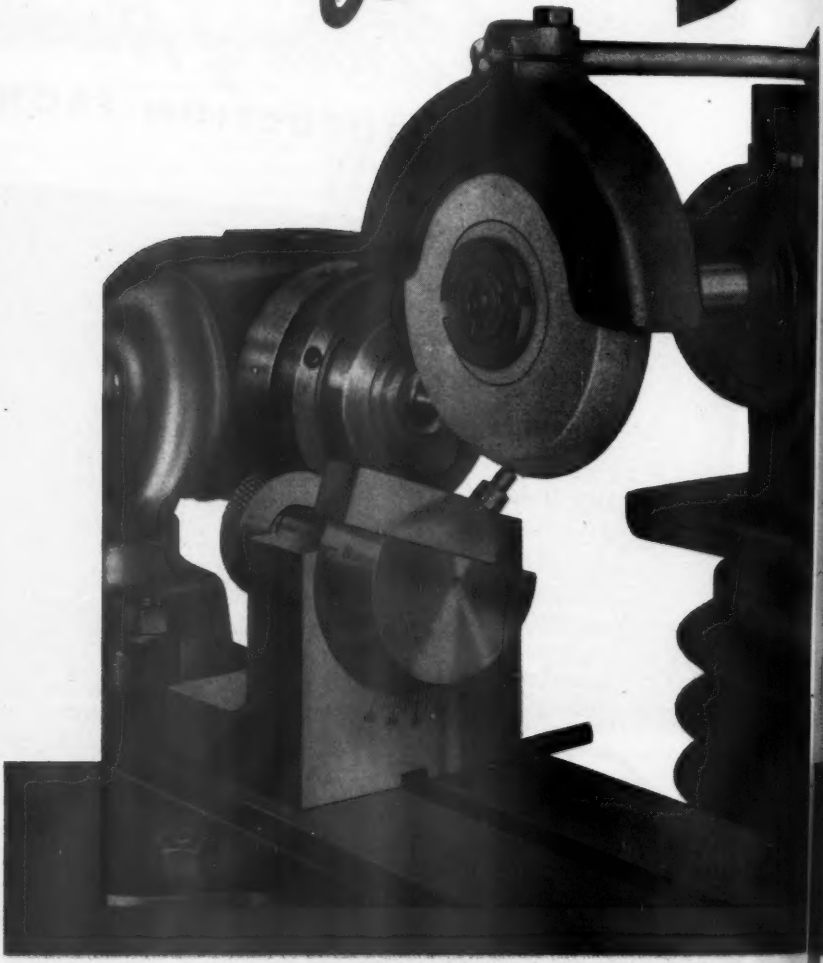

ES IT AGAIN!

...NEW "T" SLOT

QUICK ANGLE DRESSER

The Welch "T" SLOT QUICK ANGLE DRESSER is a new style Angle Dresser for use on cutter grinders or any grinding machine that has a "T" slot in the table.

THE MANY ADVANTAGES

It can be set quickly to any desired angle. It is small, compact and durable. Dial made of steel hardened and ground.

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The plain dresser is graduated in degrees. The vernier dresser reads in degrees and minutes. The vernier is part of the base block, eliminating the possibility of error that might arise if the vernier was made a separate part.

Plain Type Dresser	$72.50 NET
Vernier Type Dresser	85.00 NET

One diamond furnished with each Dresser.
Ten days free trial if desired.

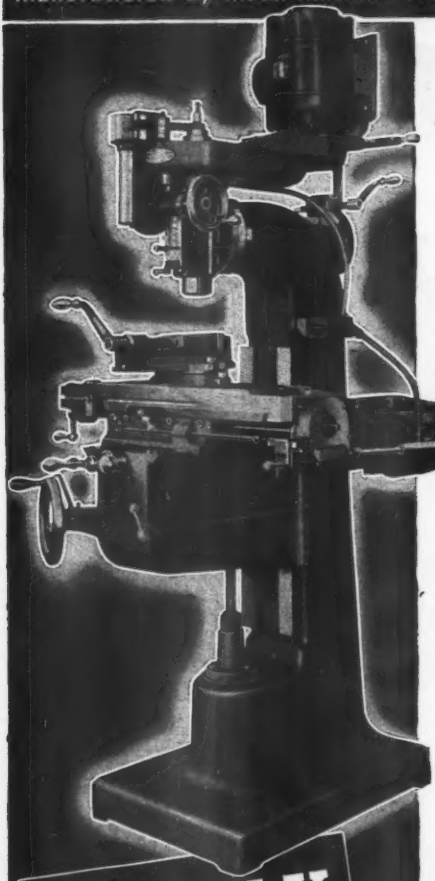
IMMEDIATE DELIVERY

WE ALSO MANUFACTURE A STANDARD ANGLE DRESSER FOR USE ON MAGNETIC CHUCKS ONLY

Welch INDUSTRIES, INC. 19400 W. 8 MILE ROAD
MACHINE TOOL DIVISION DETROIT, MICH.

INDEX MILLS

Manufactured by Index Machine and Tool Co., Jackson, Mich.



CHECK THESE FEATURES!

★ Precision Ball Bearing Spindle that will require no attention for two years.

★ Swivel Head which can be set 90° right or left.

★ Super construction sensitive enough to do work with end mills 1/8" diameter yet rugged enough to use 3/4" end mills taking full cuts 24 hours a day.

★ Verniers for locating, and power feed to spindle for boring.

★ A versatile machine that can be used in the tool room or on the production line.

Send inquiries for immediate quotation and quick delivery to Factory Sales and Distributing Agents.

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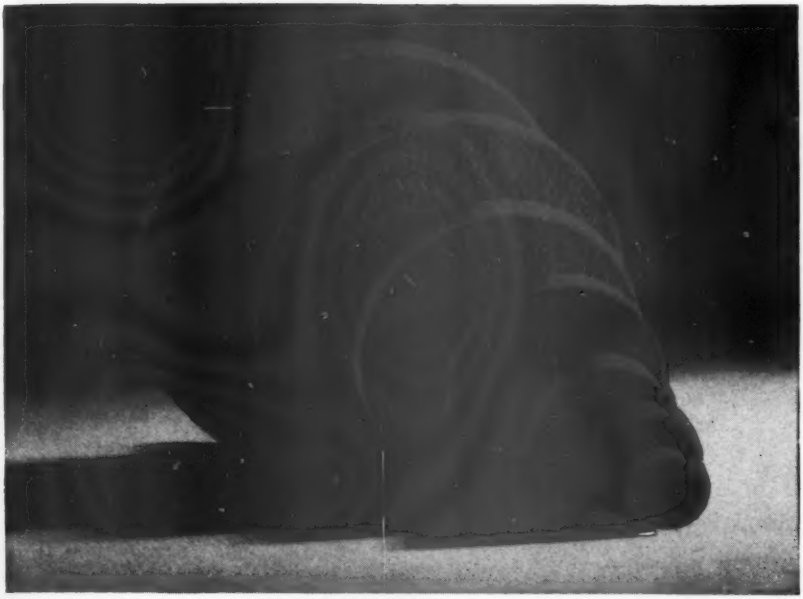

WE DELIVER ON TIME

Yes

CHICAGO GRINDING WHEELS

The wheels of proved quality—known for performance, cutting and long life. Any shape, grain and grade, any size up to 3" in diameter. From this army of wheels you can select one custom built for your job.

No holding up vital jobs while you wait for your grinding wheels or mounted wheels*.

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Fully approved and endorsed by W P B, here's our wartime speed setup:

- Manufacture only wheels 3" in diameter and under. To speed production, larger sizes are eliminated for the duration.
- No quitting whistle. We are on the job making wheels 24 hours a day, every day.
- Our central location brings us closer to many plants. No time lost in transfer connections or long distance shipping.

TRY ONE—Tell us the kind of equipment, the job, and size wheel you want to try. We'll send it postpaid.

Catalog Mailed on Request

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*Half a century of specialization has established our reputation as the Small Wheel People of the Abrasive Industry. You can bank on us.

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D.R.&T. CO.

ESTABLISHED 1938

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Staffed with an engineering and master-mechanic personnel of widely diversified and skilled experience guarantees our patrons proper attention at all times, assuring perfect material and workmanship.

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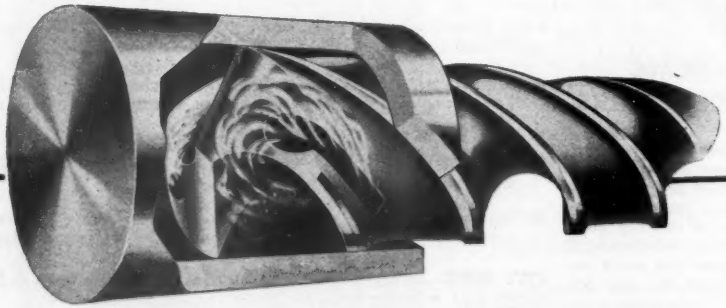
OIL HOLE DRILLS • SPECIAL REAMERS
CIRCULARITY RELIEVED REAMERS
CIRCULARITY RELIEVED END MILLS
SPECIAL TOOLS



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as a fighter plane

HOLDS FIRM
as the Marines on Guadalcanal

ACCURATE
as a Yankee sharpshooter

EFFICIENT
as America's production lines

IT HELPS WIN THE BATTLE OF PRODUCTION

Thompson SPRING COLLET Adapter

Special wrench supplied with each adapter. Standard spring collets available on order.

Designed in two simple parts, Thompson Spring Collet Adapter is quick and easy to apply... eliminates awkward, bulky chucks ...gets closer to the work, yet allows free access.

A better adapter means faster, better work. The Thompson trademark means a better adapter!

Write for literature and prices

Army-Navy "E" awarded to Auto-Ordnance Corporation for excellence in production of "Tommy" Guns

AUTO-ORDNANCE Corporation

THOMPSON TOOL DIVISION

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PLAIN MILLING MACHINE

for

SPEED, ACCURACY AND VERSATILITY

in

ARMAMENT PRODUCTION

Infinite Spindle Speeds—25 to 500 r. p. m.

Standardized Spindle Nose. Spindle heat-treated chrome-nickel steel with No. 40 taper.

Motor In Base Drive. 3 hp U. S. Vari-Drive motor. Twin-Disc Duplex Machine Tool Clutch.

Heavy Rugged Construction. Heavily proportioned column houses motor drive and power shafts.

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Spindle is heat-treated chrome-nickel steel and runs in heavy phosphor bronze bearings compensated for wear and equipped with alemite lubrication fittings. Standardized flange spindle nose has No. 40 taper.
Controls for speed and feed are centrally located for ease of operation.

Table working surface	46" x 10¼"
Longitudinal power feed	25"
Transverse power feed	9"
Vertical hand feed	19"
Max. distance spindle to table	19"
Number of geared feeds	16"
Range per spindle revolution	.005" to .212"

WRITE FOR FOLDER

UNIVERSAL MODEL ALSO AVAILABLE

J. L. LUCAS & SON, INC.

BRIDGEPORT, CONNECTICUT

In the great plants of the Link Belt Company, batteries of Acme-Gridley Automatics turn out endless streams of precision parts for Ordnance and Ammunition.

Better ammunition-QUICKER!

IT IS AN UNCENSORED FACT that our armed forces pack more fire power than the enemy, and use it more effectively.

Acme-Gridley Automatics are helping to produce the better guns and better ammunition that point the way to Victory through superior marksmanship and "more hits".

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The effective production work of Acme-Gridleys will be equally effective in turning out the improved goods on which peacetime prosperity must be based—at lower costs than we have ever before seen.

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ACME-GRIDLEY 4-6 AND 8 SPINDLE BAR AND CHUCKING AUTOMATICS • SINGLE SPINDLE AUTOMATICS • AUTOMATIC THREADING DIES AND TAPS • THE CHRONOLOG • LIMIT AND CONTROL STATION SWITCHES • SOLENOIDS • CENTRIFUGES • CONTRACT MANUFACTURING

54 YEARS AGO ...

AND 2 WARS !

In 1889, Charles Moffat Smillie, Senior, started Detroit's first tool shop. Industrial progress was represented by the Iron Horse. The automobile was still a dream. Over the years, Smillie has grown from a few men to a modern organization producing precision parts. Today, serving in our second war, Smillie precision parts are making vital contributions to America's war products. Deservedly, we salute our founder, Charles Moffat Smillie, Sr., who at 82 still carries on — and symbolizes fine craftsmanship and quality—our goal—today and tomorrow.

C. M. SMILLIE & CO.

1108 WOODWARD HGTS., FERNDALE, MICH.

PRECISION ★ YESTERDAY ★ TODAY ★ TOMORROW

Primary Production Precision

for the BLUE PRINTS of TODAY and TOMORROW

Putting into the blueprints of the future the products of today and tomorrow is the outstanding contribution of broaching today. For whether these products be aircraft, armament or adding machines, broaching will produce more, more accurately . . . and for less expensively. Investigate Primary Production Precision—broaching today.

Lapointe Horizontal Broaching machine (HP-100) with complete automatic controls, rapid return speed and modern, engineered construction.

ARMY NAVY

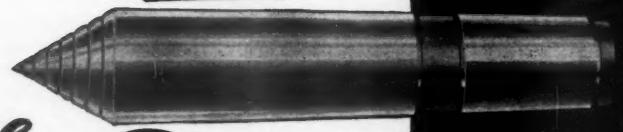
LAPOINTE Machine Tool Company

HUDSON, MASSACHUSETTS, U. S. A.

for CLOSE TOLERANCES

RIGID SUPPORT
No balls, rollers, or races to wear out and cause uneven tooling.

BETTER LUBRICATION due to exclusive helical groove*



Use CMD *Helical Groove* CENTERS

AND

CMD CENTER POINT OIL

★ The exclusive left hand helical groove in CMD Centers holds a reserve supply of lubricant and conveys it constantly to the extreme point of center. No burned out centers! No stopping machine to relubricate centers!

When CMD Helical Groove Centers are used with CMD Center Point Oil, they can be drawn up tight against the work, permitting closer tolerances and finer precision results. Send coupon now for details and FREE sample kit of the oil.

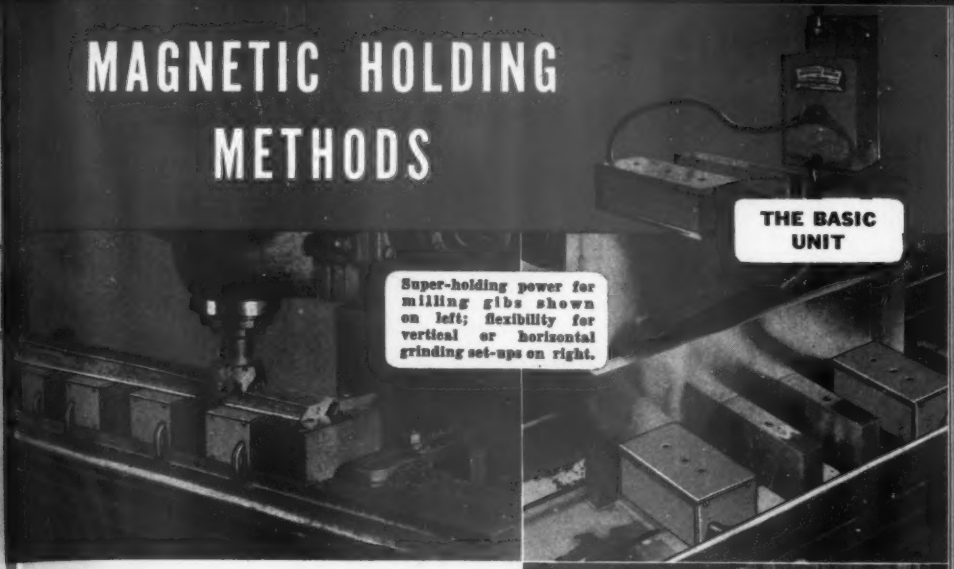
Write for FREE *Sample Kit*

CHICAGO MANUFACTURING & DISTRIBUTING CO.
Dept. 8J, 1928 West 46th St., Chicago, Ill.

☐ Send circular on CMD Helical Groove Centers
☐ Without obligation to us, send FREE sample kit containing a tube of CMD CENTER POINT LUBRICANT and a tube of CMD CENTER POINT LUBE (grease) with directions for making an amazing, simple test.

NAME .....
FIRM NAME .....
ADDRESS .....

MAGNETIC HOLDING METHODS



THE BASIC UNIT

Super-holding power for milling gibs shown on left; flexibility for vertical or horizontal grinding set-ups on right.

New Holding Applications

Methods engineers in many war industries have applied the ANDERSON & BROWN Magnetic Chucks with the "Body Flo" magnetic holding method to solve many tricky holding problems as well as speedy handling of work.

Many of these set-ups will not be disclosed until Victory is Won. However, you may learn now how ANDERSON & BROWN "Body Flo" Magnetic Chucks may be applied to solve your holding problems, to reduce or eliminate your cost of fixtures and to speed your production.

The basic unit, a precision instrument, may be applied to your surface grinders in the tool room and for production on your grinders, planers or shapers and for certain types of work on millers.

The application of two or more units, known as "Multiple Units", for large surface grinders, planers, etc., is now an accepted practice where more than the usual holding power is required.

Planing set-up for gibs shown above: grinding set-up for small work shown below.

GET THIS Super Power and Flexibility
Send for "Magnetic Chucking Revolutionized"

ANDERSON & BROWN CO.

2034 East 22nd Street • • Cleveland, Ohio

SAFEGUARD YOUR PRODUCTION FROM THE SCRAP PILE

use The

SCHERR LIMITED BUDGET INSPECTION LABORATORY

MADE IN U. S. A.

1. THE WILDER PROJECTOR

The Wilder Projector enables you to see exactly where tools, templets, gages, threads, etc. vary from specified dimensions and contours, and how much they are out. Magnifications available from 10x to 100x.

BASE PRICE.....$267.50 F.O.B. Waltham

2. A SET OF GAGE BLOCKS

Accurate within .000008" is a necessity to provide the basic standard of measurements, from which all production starts and all measuring tools and gages, used throughout the shop are checked and set. There are large and small sets of our Ultra-Chex lines to suit all requirements.

34-block set.....$125.00 F.O.B. New York

Note also adjustable Snap Gages.

3. SCHERR COMPARITOL

Gives accurate dependable readings in 1/10000". Gage blocks, plus gages, tools are checked for size, tolerance and wear. Mass produced parts such as bearings, pins, bushings, are rapidly checked without dependence upon the skill or "feel" of the operator.

Standard size 0—6".....$195.00 F. O. B. New York

Heavy-duty 0—8" size.....$250.00 F. O. B. New York

4. OPTICAL PARALLELS

Required to inspect the surface of gage blocks, lapped surfaces of all kinds and parallelism of micrometer anvils. Single Parallels.....$10.00

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5. REED PRECISION MICROMETERS

1" and 2" in 1/1000" and with vernier to 1/10000".

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6. SPENCER BINOCULAR MICROSCOPE

With three dimensional vision reveals scratches, surface finish, imperfections, which cannot be seen with ordinary microscopes showing in one plane of vision.....$153.50

7. ATLANTIC ADJUSTABLE LIMIT SNAP GAGES

Our snap gages are made to American Gauge Design Standards. Frames are made of MEEHANITE, a special material chosen because it retains its form. These gages are being used in government arsenals and numerous other plants.

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QUICK production is not your only problem. Machine tools may be speeded up, hours saved by better set-ups, over-time and extra shifts may be installed. Yet this will be of no avail or benefit to anyone if the accuracy of your product is lost with your material ending on the scrap heap.

The best investment for any shop is in inspection tools to detect and eliminate the errors at the source, before they can affect production. Give your men the right tools to measure with. Remember that whether you manufacture to close tolerances of "tenths" or to wide tolerances of plus or minus .002", you must still start with the basic accuracy in tenths of thousands or else your work will not interchange with that produced in other shops. Invest in the Scherr Limited Budget Inspection Laboratory to guard against future rejections, disputes and loss of time, labor and material.

●

Write, wire or telephone Canal 6-1464 for quotation and delivery dates, complete literature.

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6 STEPS TOWARD TOP PERFORMANCE, WITH CARBIDES, WHEN YOU *CUT STEEL*

● Important in getting top performance, when cutting steel with carbides, are the six steps shown above. When correctly applied, carbide tools produce results far surpassing the performance of ordinary tools. They operate at machine speeds as high as 4 to 5 times faster than ordinary tools, stay sharp up to 10 times longer, and increase output often as much as 300%.

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63% OF ALL **CARBOLOY** CEMENTED CARBIDES PRODUCED TODAY FOR MACHINING PURPOSES IS USED FOR **CUTTING STEEL**

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FOUND in your present machines when equipped with TECO CARBIDE DIES

Your present machines will produce more cartridge cases when equipped with TECO Carbide Dies. Here's why: TECO Carbide is manufactured to rigid standards of hardness, density and uniformity. It has greater resistance to frictional wear, thus stays on the job longer—produces much greater quantities of smooth finished, accurate-gage cases between die changes.

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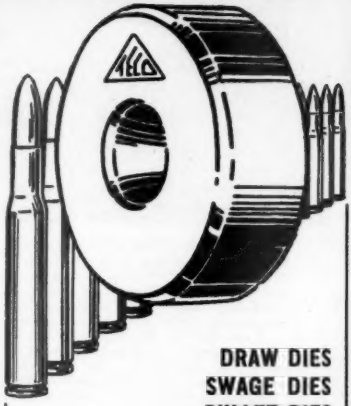

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4 HANDLES—
IN PLASTIC CASE

Complete Master Set of Standard Plug Gages

For the first time—a complete Master Set of standard plug gages for hole inspection, including 147 plugs and 4 handles. Plugs are set in increments of 1/64ths, starting at 1/4" and going to 1". There are three plugs of each nominal size—.0005 over, standard, and .0005 under.

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Sav-Way Plug Gages are produced by skilled gage makers; they have been proven in actual use on aircraft and ordnance parts of the highest accuracy.

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Angle jobs need not require the full time of your highly trained men, or hold up production and tie up special machines. With UNIVERSAL 3-Way Angle-Set Precision Vises on your production lines, you can handle any kind of single or compound angle work at mass-production speed and cost — and put it on r standard miller or drill press! This free folder shows the way.

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SEE HOW UNIVERSALS can do these things in your own plant, in the hands of youngsters! This free folder gives complete details and specifications. Twelve installation drawings show actual production set-ups. Send the coupon for your copy today.

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Rush free folder telling how Universals convert standard tools for angle work. PLEASE PRINT:

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ask for this 7-MINUTE STORY

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Here's the brief factual report of how the **HECKER** organization designs and builds production tools for many industries—both large and small.

Perhaps it suggests a solution to some of *your* tooling problems. If there's the slightest possibility of your needing outside specialized service on production tooling—make a request for your copy of this **HECKER** booklet to the nearest A. W. Hecker office (addresses below)—mention Dept. I.

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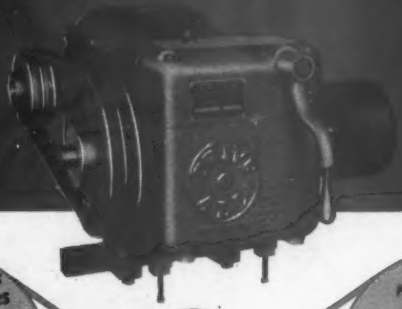

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Many War-time economy and efficiency records have resulted from the better control, better lighting, higher unit production, faster speeds and heavier feeds made possible by the application of DRIVE-ALL Selective Speed TRANSMISSIONS to machine tools. What DRIVE-ALL has done under production pressure you can be sure DRIVE-ALL will continue to do after war when *economies* in production resume the importance they always have in competitive markets. Therefore, if you *build* machinery, if you *use* machinery, if you *sell* machinery involving selective speed you ought to have *all* the facts about DRIVE-ALL.

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An entirely new method of manufacture . . . employing Melin-Patented *Micro-Precision* Machines . . . *engineers* longer life into MELIN End Mills . . . gives you these three advantages:

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All decarburized metal is *ground off* . . . not just polished down! Special-formula hardness retains sharpness longer!

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The Melin-patented "Lead Master" eliminates guesswork . . . *assures* the uniformity of each flute!

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The Melin "Concentri-matic Fixture" makes eccentricity impossible . . . *guarantees* concentricity!

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THE ROTOREX GRINDER For Your Toolroom

Internal Grinding

Means MORE SATISFACTORY PERFORMANCE FOR YOU

Cylindrical Grinding

INCREASED FACILITIES enable us to make PROMPT SHIPMENTS

Thousands of Rotorex Grinders are in service all over the world performing operations with speed and precision on vital war material.

On a production line, as well as in tool maintenance a wide range of work can be done on the Rotorex such as: cylindrical and internal grinding as well as sharpening of all kinds of tools to the closest of tolerances.

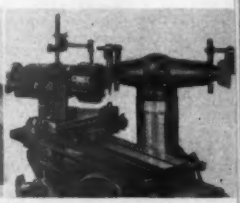
Easy interchangeable attachments for faster set-ups, selective speed range from 3000 to 6000 rpm are outstanding features.

Simplicity of design and operation makes it possible for even unskilled workers to operate with the highest efficiency.

Write today for the new 100 page grinding handbook No. 502 for the Douglas-Rotorex Universal Tool and Cutter Grinder.

Top Grinding Attachment

Sharpening Helical Cutter



Radius Grinding Attachment

4351

DOUGLAS MACHINERY CO., Inc.

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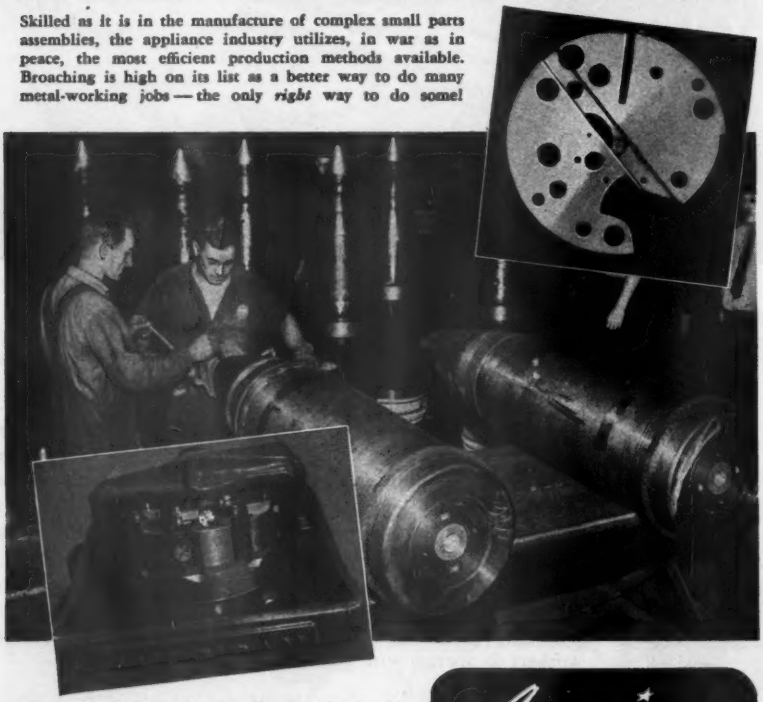
LINES BEHIND THE LINES

FROM RANGES, REFRIGERATORS AND RADIOS . . . TO BOMBS, SHELLS AND TORPEDOES . . . THE APPLIANCE INDUSTRY CONVERTS TO WAR!

Skilled as it is in the manufacture of complex small parts assemblies, the appliance industry utilizes, in war as in peace, the most efficient production methods available. Broaching is high on its list as a better way to do many metal-working jobs — the only *right* way to do some!



UPPER RIGHT. Broaching the diagonal slot in this brass fuse part is typical of the production-with-precision work required. Using an American 16" Rotary Machine, with 8-station fixture designed for manual loading, automatic clamping and automatic discharge, extremely high output is obtained.

LOWER LEFT. American broaching engineers designed this fixture to locate and index the part from three holes, with further support by recessing part in toughened steel block to minimize burr. American's *complete* broaching service—machines, tools, and engineering — contributes mightily to winning war production, profitable post-war production.

BROACHING IS BETTER THE *American* WAY

American
BROACH AND MACHINE CO.
ANN ARBOR, MICHIGAN
BROACHING MACHINES
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SPECIAL MACHINERY
DIVISION OF

LIMA GEARSHIFT DRIVES
for machine tools and other production equipment reduces "absenteeism" of machines and operators to a minimum.

Lima's simplified design, sturdy construction assures fast, smooth, accurate operations hour after hour, day after day, with less maintenance attention and with less operator fatigue.

Lima's are safe... it is not necessary for the operator to touch the belt at any time in changing or making new machine set-ups.

The Lima line also includes Pedestal Grinders, Magnetic Polishing Lathes and Electric Motors.

Wire or write for address of Lima Engineering Service nearest you.

Large enough to successfully serve you, yet small enough to give personal attention to your needs.

THE LIMA ELECTRIC MOTOR CO.
862 FINDLAY ROAD
LIMA, OHIO
REPRESENTATION IN MOST PRINCIPAL CITIES
LIMA GEARSHIFT DRIVES - LIMA ELECTRIC MOTORS
LIMA MAGNETIC POLISHING LATHES - LIMA PEDESTAL GRINDERS

KEEP 'EM SLUGGING
BUY WAR BONDS
Atlas
10-INCH
LATHE
CONDENSED SPECIFICATIONS
Swing over Bed 10¼"
Swing over Carriage 6¼"
16 Spindle Speeds 28 to 2072 RPM
Thread Cutting Range 4 to 96 per inch
Four Bed Lengths 18" to 36" centers
Instantly reversible power cross feed and power longitudinal feed, complete V-belt drive, precision-ground bed ways.

"MATCH THE MACHINE TO THE JOB"

The machine of the hour for total war is the metal-working lathe.

And busiest of the modern, compact lathes is the F-Series Atlas. It's a new victory factor in this war because it lets every production manager *"match the machine to the job"*— using massive machines full-time on jobs where size and power are really needed with *Atlas lathes to take over small-parts production so that capacities of larger machines will not be wasted.*

Note the Atlas condensed specifications above. Check them against your small-parts needs with the idea of matching the machine to the job. For complete specifications and the name of the distributor nearest you write Atlas Press Company, 812 North Pitcher Street, Kalamazoo, Michigan.

A BIRTHDAY STATEMENT ABOUT "MX" WHEELS

THE announcement of "MX" Wheels in 1942 introduced a new abrasive tool to industry.

These wheels were created by Carborundum to perform a specific function—the removal of "disturbed metal" such as burrs and tool marks, resulting from grinding, machining, boring and similar operations.

Research and field tests showed "MX" Wheels could do this job better than ordinary finishing methods. A year's experience has confirmed their advantages.

"MX" Wheels, fabricated from cotton fibre intermingled with abrasive grains are unlike any other abrasive product. They have unique characteristics.

Because of their "cushioning" effect "MX" Wheels literally hug the work. Chatter and vibrations are reduced, smooth finishes assured.

"MX" Wheels are best suited for breaking corners, removing burrs and polishing grooves or slots. For burr removal on jobs where surrounding surfaces must be kept free of abrasive marks . . or for polishing which must be done with light stock removal to maintain tolerance limitations . . they are ideal.

A request addressed to us, Dept. TD, at Niagara Falls, will bring you literature further describing the wheel and illustrating a few of its many uses.

CARBORUNDUM
ABRASIVE PRODUCTS

THE CARBORUNDUM COMPANY, NIAGARA FALLS, N. Y.

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MANUFACTURERS OF GRINDING WHEELS, COATED ABRASIVES, SUPER REFRACTORIES, HEATING ELEMENTS

Sales Offices and Warehouses in New York, Chicago, Philadelphia, Detroit, Cleveland, Boston, Pittsburgh, Cincinnati, Grand Rapids

(Carborundum and Alundite are registered trade-marks of and indicate manufacture by The Carborundum Company)

EX-CELL-O CYLINDER BORING MACHINE

To left: **Ex-Cell-O angular type machine equipped with six spindles to finish bore valve seats and valve guide holes in cylinder head of aircraft engine on a production basis. Each spindle is individually adjustable for depth of cut, as are the tools in the boring bars (boring bars, not shown in picture, are piloted in the fixture).**

SPECIAL MACHINES

. . . for today's production . . . and tomorrow's

For years Ex-Cell-O has been familiarly known as "the headquarters" for special single-purpose machines for turning out accurate parts at a high rate of speed . . . machines that frequently perform numerous operations in one setting of the work and often bring not only a substantial increase in the number of parts produced hourly but also improved quality and reduced unit cost. . . . This is why so many manufacturers have turned to Ex-Cell-O for equipment to meet their war production schedules; why Ex-Cell-O designed machines will figure in the post-war plans of an increasing number of American industries. . . . If you are planning for tomorrow, when the new standards will necessitate costs that are competitive, take advantage of the wide engineering experience and extensive manufacturing facilities that for many years have made Ex-Cell-O a leader in the precision machine tool field.

EX-CELL-O CORPORATION • DETROIT, MICH.

EX-CELL-O SIX-WAY MACHINE

Below: Ex-Cell-O six-way machine for drilling, broaching and reaming valve guide holes in a magnesium crankcase. This machine is equipped with four standard hydraulic power units and two Ex-Cell-O special hydraulic broaching units.

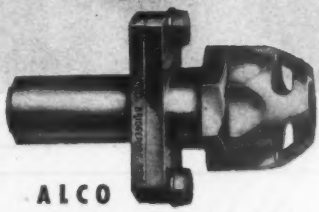
XLO

EX-CELL-O *for* PRECISION

Precision THREAD GRINDING, BORING AND LAPPING MACHINES • TOOL GRINDERS • HYDRAULIC POWER UNITS • GRINDING SPINDLES • BROACHES • CONTINENTAL CUTTING TOOLS • DRILL JIG BUSHINGS • DIESEL FUEL INJECTION EQUIPMENT PURE-PAK CONTAINER MACHINES • R. R. PINS AND BUSHINGS • PRECISION PARTS

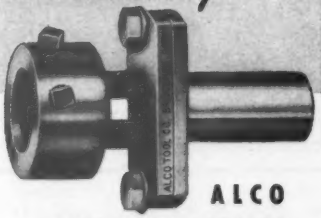
ALCO
EFFICIENT TOOLS

For the Aviation Industry



ALCO
ACORN DIE HOLDER

Hundreds of small parts made on automatics and dozens of larger units on hand screw machines and turret lathes are profitable production items for contractors and sub-contractors serving the airplane industry. Aviation is playing the major role in softening up the enemy today, and will be an important factor in expanding world commerce in the days of peace to come.



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BUTTON DIE HOLDER

Standardize now on ALCO Die Holders, either Button or Acorn Type, for guaranteed accuracy of all outside threading operations. The floating operation of the flanges on both types results in absolute concentricity when setting up, and maintains perfect threading on exact centers throughout the run. Quick and easy set-up for high speed production.

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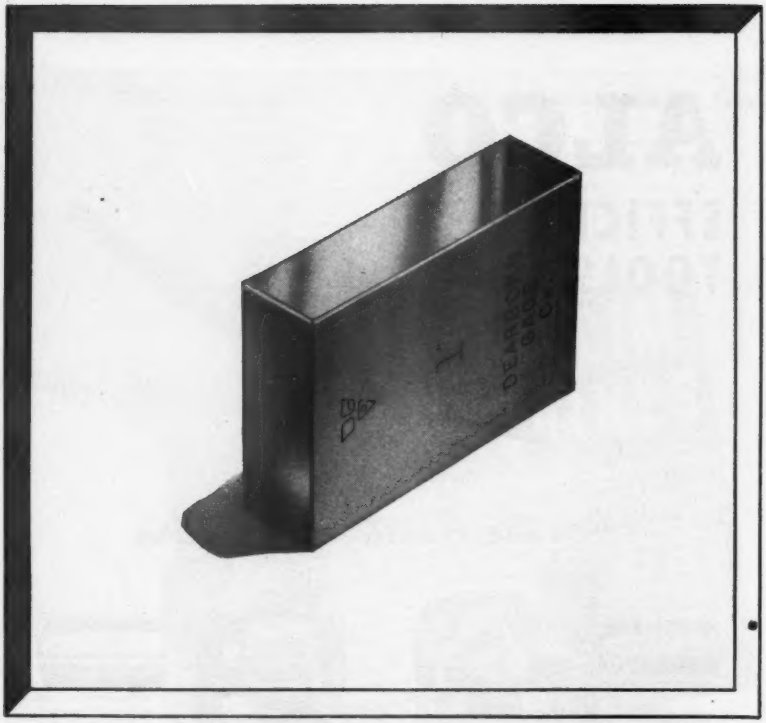

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Originators of Chromium Plated Gage Blocks

Upp and Adam by Mason & Hahn

You can accomplish zero, without using the right welding material and correct engineering for tool and die welding. We are able to furnish both the proper electric arc or oxyacetylene tool steel welding wires plus specialized engineering direction. The Eureka tool steel welding wire line is the only answer. Eureka tool steel rods are obtainable for oil hardening, air hardening, water hardening, hot working tool steels or alloy purposes. They can be utilized by your own welders for maintenance repair of your present dies or for composite construction of new dies by applying proper tool steel welding rods as cutting edges on ordinary carbon steel (in most cases without subsequent heat treatment). Or you may send your broken high speed cutting tools to our plant for reclamation by the "SUTTONIZING" principle.

WELDING EQUIPMENT & SUPPLY COMPANY
226 LEIB ST., DETROIT, MICHIGAN

Five Brothers*..

..and an Idea

IT ISN'T OFTEN that an idea created in the minds of boys will materialize in later life. With the five Turner brothers, William, Cort, Frank, Charles, and Robert, their boyhood idea that some day they would be in business together, overshadowed all the obstacles of hard work, and study to make this idea a reality. ★ Finally in April 1939 they purchased their first grinding machine and formed their own company. From this modest beginning they gradually won recognition among manufacturers for precision-built gauges. This recognition made expansion necessary, and today their company occupies one of the most modern buildings for the manufacture of gauges in the country. ★ The ℄ stamped on a gauge represents a product backed by the integrity of five brothers and their practical knowledge of precision gauges.

**Since May 7, 1942, William Turner, of the U. S. Navy, has been reported missing in action in the Coral Sea Battle.*

The Stamp ℄ of Precision

TURNER GAUGE GRINDING COMPANY

2624 HILTON ROAD · · FERNDALE, MICHIGAN

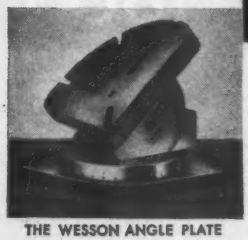
Try Sutton Full-Floating Style "F" COLLETS with interchangeable, replaceable jaws—each jaw floats independently, comes to full bearing on stock—allows collet to run as true as the machine spindle. One master per machine with an assortment of jaws will handle your work, round, hex and square, up to machine capacity. Jaws are quickly changed without removing master from tube. Patented Diamond Grip takes horizontal and rotating thrusts at an angle—gives full grip with one-third less tension. With Style "F" Collets, use the companion Style "L" Feeders, with interchangeable, replaceable pads.

SUTTON TOOL COMPANY • 2895 W. Grand Blvd. • DETROIT

See our representative ***or send for Catalog 15***

SUTTON Diamond Grip **COLLETS**

quicker SET-UPS *positive* PRECISION ON COMPOUND ANGLES



THE WESSON ANGLE PLATE

You can adapt standard machine tools *immediately* to difficult compound angle work . . . *slash set-up and tool-up time* . . . speed up precision angle milling, drilling, grinding . . . with Wesson Universal Vises. Accurately graduated in all planes to insure precision. Strong construction and rugged cradle maintain greater rigidity, for faster metal removal. Compact . . . *lower in height than any other Universal Vise* . . . works in closest quarters.

WESSON & CO. *Universal* VISES
BUILT TO WESSON STANDARDS OF QUALITY AND PRECISION

AVAILABLE *NOW*
Immediate Deliveries
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DETROIT, MICHIGAN
(Ferndale Station)

TWO SIZES . . . PRICED FOR EVERY SHOP!
When fitted with Slotted Surface Plate, the Wesson Angle Vise functions as a Universal Angle Plate.

WESSON CO., Detroit (Ferndale Station), Mich.
Please send me illustrated bulletin of WESSON Universal VISES and ANGLE PLATES.

Name and Title .....
Firm Name .....
Address .....
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FOUND.. *A New Way to Lower* WHEEL DRESSING COSTS!

TRU-THREAD DIAMOND DRESSING TOOL STEPS UP THREAD GRINDING PRODUCTION

Examine this new TRU-THREAD diamond dressing tool by Wheel Trueing Tool Company, Inc. You'll see the latest development of an organization that has spent 33 years designing. developing and building diamond tools of fine quality.

You'll see a diamond dressing tool that is setting new records of speed and economy—one that can boast production increases as high as 500% and reductions in per piece grinding costs 75%.

How is this possible? Wheel Trueing engineers have found a way of utilizing the hard characteristics of the natural uncut diamond —never before thought possible in tools of this type. The result is a tool that cuts cleaner —obtains forms faster. Forms hold longer. Fewer dressings are required. More work can be ground between dressings. Down time is reduced. And this tool can be made and reserviced on a production basis, assuring quick deliveries.

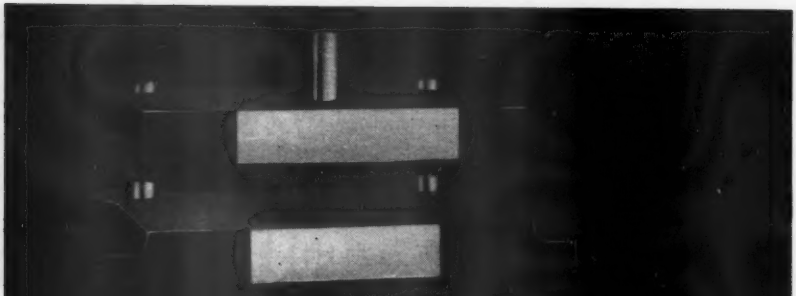
You'll learn many other advantages of TRU-THREAD TOOLS once you put them to work on your thread grinding machines. *Write or wire for further information today!*

DIAMOND TOOLS for

Straight, form, thread and radius dressing, turning, boring, gaging, and core drilling

WHEEL TRUEING TOOL COMPANY INCORPORATED

3200 W. DAVISON DETROIT 6, MICH.



DETROIT DIE SETS ★

SEMI-STEEL and ALL-STEEL STANDARD DIE SETS

SPECIAL DIE SETS

PRECISION DIE SETS

DOWEL PINS

SPRINGS

ACCESSORIES

SPECIAL SERVICE ON SPECIAL DIE SETS...

We are especially well equipped to make special die sets to your specifications and we make a sincere effort to give you the fastest delivery service that today's conditions permit.

For prompt action, send us your prints and instructions.

STEEL PLATE—*fabricated or torch cut to size or to your template.*

•

Send for catalog.

DETROIT DIE SET CORP.

2895 W. GRAND BLVD., DETROIT 2, MICHIGAN

Sales and Service Offices in—NEW YORK • PHILADELPHIA BUFFALO • INDIANAPOLIS • DAYTON • MINNEAPOLIS TOLEDO • SEATTLE • PORTLAND, ORE. • SAN FRANCISCO

HA-HA! HE THOUGHT A SNAKE BIT HIM! I DON'T SEE HOW A GUY COULD BE ABSENT-MINDED ENOUGH TO THINK THAT A SNAKE WOULD BE IN A BIG MODERN PLANT LIKE THIS!
THAT'S JUST TH' REASON! IT'S SO MODERN THAT ONLY A FEW MONTHS AGO WE WAS PICKIN' WILD BERRIES RIGHT ABOUT HERE--AND THERE WAS SNAKES IN TH' BUSHES!
T. M. REG. U. S. PAT. OFF.
COPR. 1943 BY NEA SERVICE, INC.
MEMORY LANE
J.R.WILLIAMS
3-5

THAT WAS THE DAY
HE TALKED THE BOSS INTO "CHIP BREAKERS"

Chip Control avoids dangers and delays caused by long, hot, tough chips of alloy steel. Chip Control yields **short chips** that are more marketable, bring a better price, and provide a means for speedy recovery of alloys on a national scale.

For a proved method of producing **short chips** with Firthite Sintered-Carbide Cutting Tools, refer to pages 41, 42, and 43 of the Firthite Users' Handbook. Ask for Handbook FE-101.

ARMY E NAVY
Firth-Sterling
STEEL COMPANY
Offices: McKEESPORT, PA. · NEW YORK · HARTFORD · PHILADELPHIA · CLEVELAND · DAYTON · DETROIT · CHICAGO · LOS ANGELES

THE EXECUTIVE WHO STOPS TO THINK . . .

Knows that "10% for War Bonds isn't enough these days"

Workers' Living Costs going up . . . and Income and Victory Tax now deducted at source for thousands of workers . . .

Check! You're perfectly right . . . but all these burdens are more than balanced by *much higher* FAMILY INCOMES *for most of your workers!*

Millions of new workers have entered the picture. Millions of women who never worked before. Millions of others who never began to earn what they are getting today!

A 10% Pay-Roll Allotment for War Bonds from the wages of the family bread-winner is one thing—*a 10% Pay-Roll Allotment from each of several workers in the same family is quite another matter!* Why, in many such cases, it could well be jacked up to 30%—50% or even more of the family's *new* money!

That's why the Treasury Department now urges you to revise your War Bond *thinking*—and your War Bond *selling*—on the basis of *family* incomes. The current War Bond campaign is built around the family unit—and labor-management sales programs should be revised accordingly. For details get in touch with your local War Savings Staff which will supply you with all necessary material for the proper presentation of the new plan.

Last year's bonds got us started—*this year's bonds are to win!* So let's all raise our sights, and get going. If we all pull together, we'll put it over with a bang!

This space is a contribution to America's all-out war effort by

Staff of

THE TOOL & DIE JOURNAL

you've done your bit . . . now do your best!

★ ★ ★ ★ ★ ★ ★ ★ ★

RIGHT ON THE BUTTON!

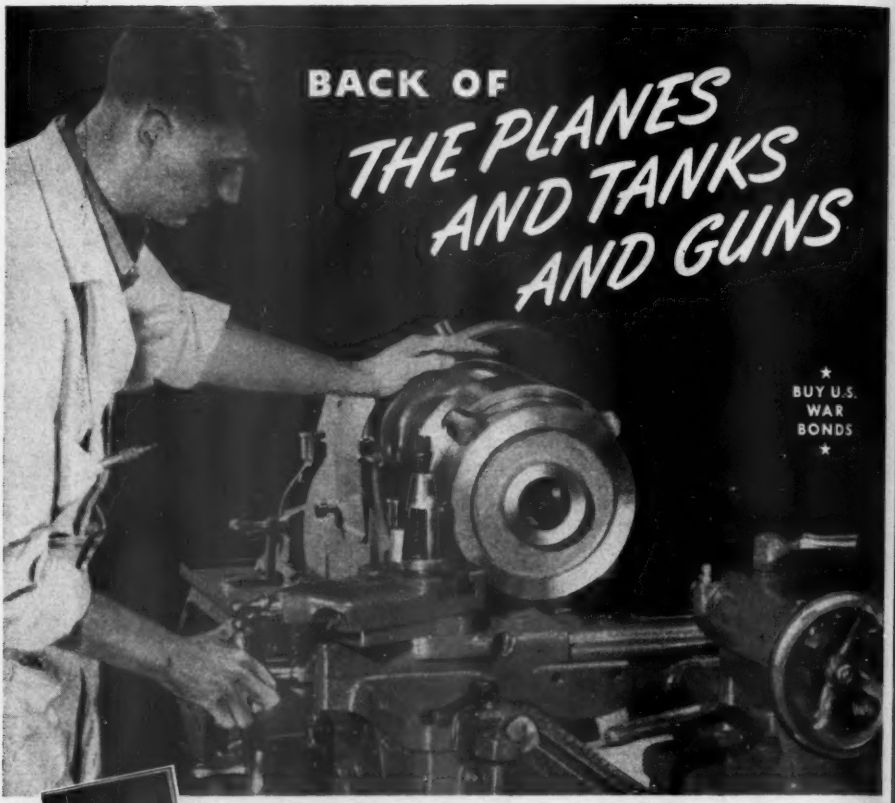
Accuracy is paramount whether it's bombing or jig boring. Perfectly true rotation of cutters is assured in the Vernon Vertical Mill and Jig Borer by two important precautions: (1) Ball bearings are of PRELOADED ULTRA-PRECISION TYPE and (2) A specially designed internal taper is accurately ground after spindle is mounted in its own bearings! Runout is eliminated for once and all by this positive method of obtaining absolute concentricity between internal and external surfaces.

Large dial indicators with measuring rods read table travel to thousandths and less! No guessing — no wear — "on the button" performance, day in, day out.

The *Vernon*
VERTICAL MILL & JIG BORER

MACHINERY MANUFACTURING COMPANY
1915 EAST 51 ST. ST. VERNON LOS ANGELES, CALIFORNIA

Vernon Line of HORIZONTAL MILLS, VERTICAL MILLS and JIG BORERS, SHAPERS and GRINDERS



Write for your copy of Catalog 100C which describes all the South Bend Lathes.

Back of the planes and tanks and guns that are flowing in ever-increasing quantities to our fighting forces is a skillfully coordinated plan of men and machines—a combination of skill, ingenuity and mechanical perfection that is going to win.

Accuracy is the key to success of this great plan. Without the split-thousandth tolerances that assure perfect interchangeability of parts, the production goals could not be attained—and not enough planes and tanks and guns would reach the war fronts.

Capable of fulfilling the demands of urgent war production, South Bend Lathes have the accuracy and speed for the most exacting precision operations, plus ruggedness and power for efficient service. They are made with 9″, 10″, 13″, 14½″, and 16″ swings in both Quick Change Gear and Toolroom models.

SOUTH BEND LATHE WORKS

South Bend, Indiana Lathe Builders For 36 Years

FEDERAL
FEDERAL PRODUCTS CORPORATION
PROVIDENCE, R.I. U.S.A.
.0001"
C21
PRECISION MAGNIFIED
INSTANTLY Federal Indicator Gages tell you not only whether right or wrong . . but how much. Tell you so clearly and positively no eye can miss.
And, Federal co-operation is so readily available you'll appreciate its suggestions for faster and better gaging.
Tell Us Your Needs. Federal Will Meet Them.
FEDERAL PRODUCTS CORP.
1144 Eddy Street Providence 1, R. I.
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New York • Philadelphia
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St. Louis • Toronto
Windsor
FEDERAL
PRECISION MEASURING INSTRUMENTS

POWER AND SPEED COMBINED WITH PRECISION FOR GREATER EARNINGS

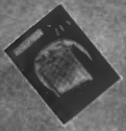
Replaceable Spindle Belts

Long Taper Key-Drive Nose

Convenient Drive Control

SPECIFICATIONS

Swing over bed, dia.	7"
Distance between centers	15"
Collet capacity, max. dia.	¾"
Step chuck capacity, max. dia.	5"
Jaw chuck capacity, max. dia.	4"
Spindle capacity, max. dia.	55/64"
Slide rest, travel of tool post slide	4¼"
Slide rest, travel of cross slide	5"
Tailstock spindle travel	3"
Spindle speeds: Eight forward and reverse	150 to 3500 r.p.m.
Weight of lathe, mounting and drive, net	650 lbs.



For Further Description Write for Bulletin 715

The Rivett No. 715 Bench Lathe fulfills two distinct functions: the production of small duplicate parts to extreme accuracy, and the finishing and fitting of fine [illegible] assembly, maintenance tool work and tool [illegible] attachments extend its usefulness [illegible] the inherent truth of the precision [illegible] spindle. The attachments, including [illegible] rest [illegible] stocks, universal grinding attachment and milling attachment. The unit motor drive provides eight selective spindle speeds and may be used with either steel cabinet or bench mounting.

ARMY E NAVY

RIVETT LATHE & GRINDER INC.

BRIGHTON, BOSTON, MASS.

The Blanchard No. 18 is a Consistent Profit Maker on Flat Surface Work

"PUT IT ON THE BLANCHARD"

Large work of thin section is usually difficult to grind. Here the Blanchard method of surface grinding shows to full advantage — the work is held on the magnetic chuck and the wheel takes broad cuts over the surface at each pass. This results in greater accuracy, finer finish, and better production — the Blanchard grinds metal at all times — not air.

Above, a No. 18 Blanchard is grinding 18" x 24" steel engine end plates of thin section. .020" of stock is ground off each side to limits of ±.002" at a production of 7 plates (14 surfaces) per hour. Note also the variety of other parts which is ground on this machine.

The BLANCHARD MACHINE COMPANY

64 STATE STREET, CAMBRIDGE, MASS.

Send for your free copy of "Work Done on the Blanchard." This book shows over 100 actual jobs where the Blanchard Principle is earning profits for Blanchard owners.

a TOOL for all TOOLS

Hard chrome plating is a tool which will make all your other tools more valuable. For example:

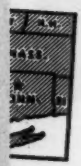
1 Blanking dies have been known to last ten times longer and operate more efficiently when plated with .0005" thickness of chromium.

2 Chromium plated gages give 3 to 7 times the wear of best gage steels.

3 Worn tools, which might otherwise be scrapped, can be plated and reclaimed overnight.

As developed by Hartford Chrome, the successful applications of hard chrome plating are almost unlimited.

Use Hartford Chrome to expedite your own tooling problems.



Above: A group of miscellaneous work picked at random from the receiving bench at Hartford Chrome.

WE SERVE NEW ENGLAND
NEW YORK & NEW JERSEY

Free "Know-How" Literature

Write For Our Circular "How Hard Chrome Plating Can Aid Your War Effort."

HARTFORD CHROME CORPORATION

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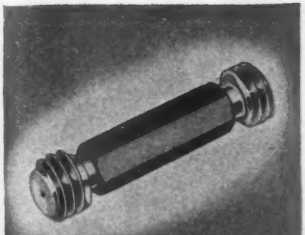
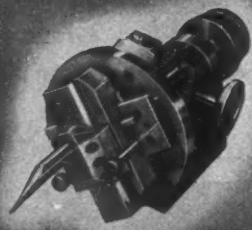
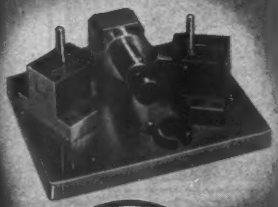
Licensed By United Chromium



The PERFEX Name

WHAT IT MEANS TO YOU..





THE NAME PERFEX represents a company that was established before the war by men who had years of experience in the manufacture of precision gages. It is the name that has been associated with accuracy, for accuracy has been the creed of the founders of the Perfex Gage & Tool Company. It is this creed, plus a thorough engineering background in gage making that has placed the name PERFEX among the leaders of gage manufacturers. Yes, PERFEX is a name that means much to its clients for they know that behind that name is a responsible organization that is built upon a sound foundation of skill and integrity. For complete information on the many types of fine gages PERFEX manufactures, write our sales department today!

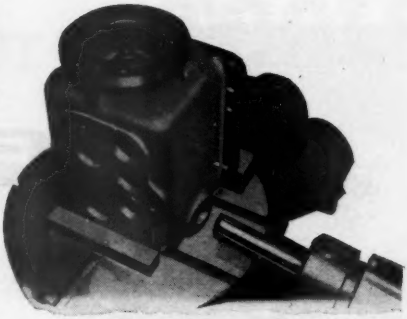
ACCURACY PERFEX OUR CREED

PERFEX GAGE and TOOL CO.

3604 GAYLORD DETROIT, MICHIGAN

THIS JOB CAN BE BORED IN A *Single* SETUP

IT'S NO TRICK WITH THE AUTOMETRIC MODEL B



This interesting boring job requires a minimum of setup time on the Autometric. Holes on all four sides of the gear case were accurately bored in relation to the large vertical bore — in one complete setup. Note that the hole is on a 15° angle.

The many-purpose Autometric Model 8 is designed for *today's* requirements — precision boring of a wide variety of mechanical parts. It handles a complete job in a single setup — faster and more accurately. Its simplicity makes training of operators easy.

Features of the AUTOMETRIC MODEL B

- Errorless measuring by the more rapid and more accurate AUTOMETRIC Method.
- Infinite variation of spindle speeds by fingertip control.
- Infinite selection of feeds by fingertip control.
- Steel Ways — hardened, ground, and super-finished.
- Spindle direct V-Belt driven — free of vibration.
- Well-ribbed body casting for permanent alignment and rigidity.

Write for full details of the Model B Autometric Jig-Boring Machine

BUY VICTORY WITH AT LEAST 10% IN WAR BONDS

Rotary Head Milling Machine
Autometric Jig Borers
Center Scope

Kearney & Trecker *Products*
CORPORATION
Milwaukee, Wisconsin
Subsidiary of Kearney & Trecker Corporation

Milwaukee Face Mill Grinder
Milwaukee Midgetmill
Milwaukee Speedmill

DO YOU KNOW THE TRUTH

About Hardness Testing?

The new Clark catalog is more than a catalog.

It is a 20-page reference manual on the history, theory, practice, and equipment for modern, scientific hardness testing. Printed in two colors, 8½" x 11", it is available without charge to manufacturing executives. Just drop a line on your letterhead to Department TD, CLARK INSTRUMENT INC., 10200 Ford Road, Dearborn, Mich.

CLARK
TOMORROW'S ACCURACY TODAY
HARDNESS TESTER

FOR THE DURATION

AND LONG AFTERWARDS

AMERICAN MONORAIL EQUIPMENT

offers versatile application without costly adjustment or lengthy engineering.

You can better your production NOW—later in the post-war period you will have essential equipment available for changes in product or process.

American MonoRail handling equipment is extremely flexible. Standard parts fit quickly and easily into complete systems that solve a wide range of handling problems.

WRITE FOR Blue Book illustrating hundreds of MonoRail installations

Don't let your handling problems impede your war work. Let our engineers show you how to speed up NOW with an eye on easy, inexpensive adjustment when Victory is ours.

THE AMERICAN MONORAIL CO.

13131 Athens Ave. Cleveland, Ohio

Heat Treat Your Own Small Parts...

SAVE TIME AND MONEY THESE 5 DIFFERENT WAYS

This small compact electric furnace is inexpensive, handy and easy to operate—ideal for small tool and die shops—saves time these five different ways:

1. Eliminates delays in sending small machine parts out to overcrowded commercial heat treaters.
2. Saves time and expense of drawing or tempering small metal parts in large furnaces.
3. Cuts handling time when normalizing or annealing small parts. No waiting.
4. Conveniently available for pre-heating for subsequent high-speed hardening.
5. Eliminates shut downs and delays in servicing emergency repair orders.

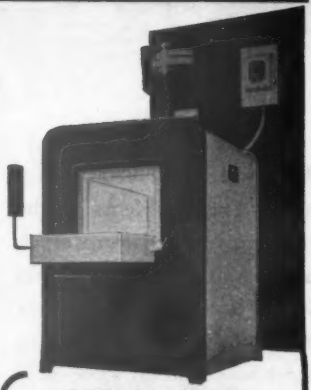
AVAILABLE IN TWO SIZES

Type	*Chamber Capacity*	*Amps 115 V*	*Watts*	*Amps 230 V*	*Price*
MH-3	8″W 6″H 14″L	29.6	3400	14.8	$124.00*
MH-4	10″W 6″H 18″L	....	4800	20.9	$191.00*

**Includes Hearth Plate*

MAX. SAFE TEMPERATURE—Continuous operation, 1750° F.; Intermittent operation, 1850° F.

AUTOMATIC CONTROL—Indicating Controlling Pyrometer—Thermo-couple and lead wire complete—$152.40.



REPLACEABLE HEATING ELEMENTS

Replaceable nickel chromium resistors embedded in rectangular refractory blocks. Elements form inner walls of furnace chamber, and may be replaced easily and quickly after removing rear panel — furnace structure remains undisturbed.

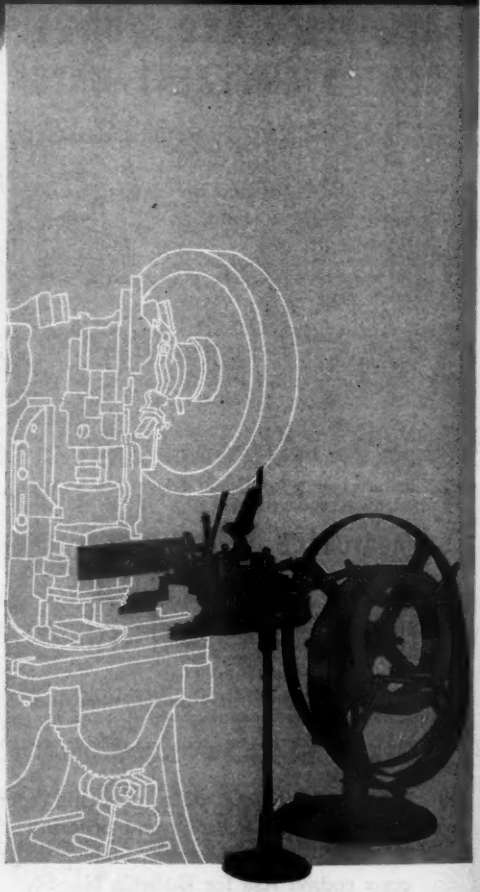
FREE—Complete data covering specifications, additional applications and ordering instructions are included in this new folder. Write for your copy today. Ask for Bulletin No. 50.

COOLEY ELECTRIC MANUFACTURING CORP.
215 S. SENATE AVENUE · INDIANAPOLIS, IND.

Our Punch Presses Are More Flexible And Productive With WITTEK *Automatic* Roll Feeds And Reel Stands

Manufacturers of metal stampings facing problems in the feeding of coiled strip stock to punch presses will find that Wittek Automatic Roll Feeds and Reel Stands conserve man-hours and achieve new high production levels.

Providing an improved and simplified method of punch press operation, Wittek Automatic Roll Feeds and Reel Stands insure rapid, safe and accurate feeding under all conditions. Made in four different types to meet all automatic feeding requirements. Write for complete details. Wittek Manufacturing Co., 4305-15 West 24th Place, Chicago, Ill.



ARMY-E-NAVY

WITTEK WMCO *Automatic* ROLL FEEDS and REEL STANDS

For All Makes and Sizes of Punch Presses

Kut Kost

- HIGHER SPEEDS
- HIGHER FEEDS
- INCREASED OUTPUT
- DECREASED COST

The New Centrifugally Cast Cutting Alloy Containing BORON

GRADE V: For heavy roughing on all types of high tensile strength materials (1/32" to 1/8" feed)
Rockwell "C" hardness 61-63

GRADE X: For medium roughing and semi-finish on all high tensile strength materials (.010" to .032" feed)
Rockwell "C" hardness 65-67

GRADE XV: For finishing cuts on all types of materials. Also roughing and semi-finish on low tensile strength materials such as bakelite, brass, bronze, aluminum, copper, etc.
Rockwell "C" hardness 68-70

RECOMMENDED SPEED INCREASES OVER HIGH SPEED STEEL:

Low tensile strength materials	100% to 300%
Cast iron and semi-steel	100% to 300%
Steel castings	50% to 200%
Tough alloy steels	100% to 400%
Stainless and manganese steels	100% to 500%

KUTKOST SOLID TOOL BIT PRICE LIST (*Now ready for delivery*)

Size	Price Each	Size	Price Each	Size	Price Each
¼ x ¼ x 2¼	$ .95	⅜ x ⅜ x 3	$1.65	½ x ½ x 4	$3.25
5/16 x 5/16 x 2½	1.25	7/16 x 7/16 x 3½	2.40	⅝ x ⅝ x 4	4.70

GENERAL TOOL AND DIE CORP.
553 PROSPECT ST. EAST ORANGE, N. J.

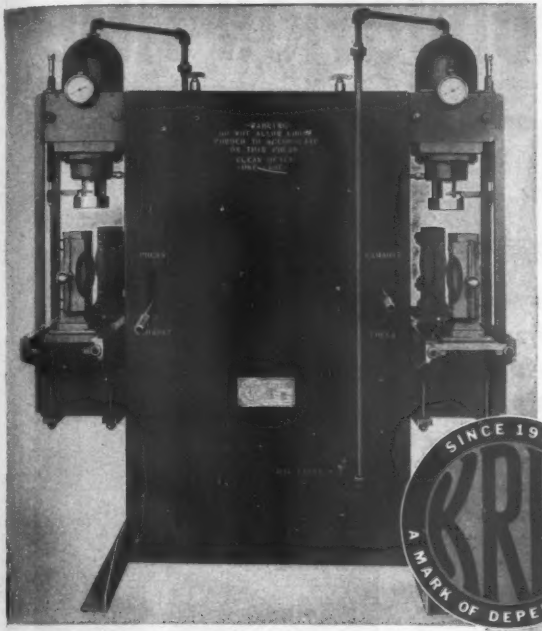
Tannewitz
VARIABLE SPEED BAND SAWS
Are Metal-Cutting EXPEDITERS!

Removing gates and risers from steel, cast iron, manganese, bronze, hard and soft brass, aluminum and magnesium castings, as well as many other metal cutting jobs handled with great dispatch and surprising savings on TANNEWITZ VARIABLE SPEED BAND SAWS. And since they are available in any 3:1 speed ratio from 100:300 to 1000:3000 blade feet per minute, with instant adjustment to intermediate speeds, one machine serves ideally for cutting a variety of materials. Made with 30", 36" and 42" wheels.

Other models (single speed) for such purposes as sawing large blocks of aluminum and magnesium, cutting large steel templates, etc., are available in capacities and speeds to ideally accommodate work of practically any size or character. Get a line on the TANNEWITZ metal cutting Band Saw that fits your particular needs. It will save time and repay its cost many times over. Simply ask for "Metal Cutting Band Saw Bulletin".

THE TANNEWITZ WORKS, GRAND RAPIDS, MICHIGAN

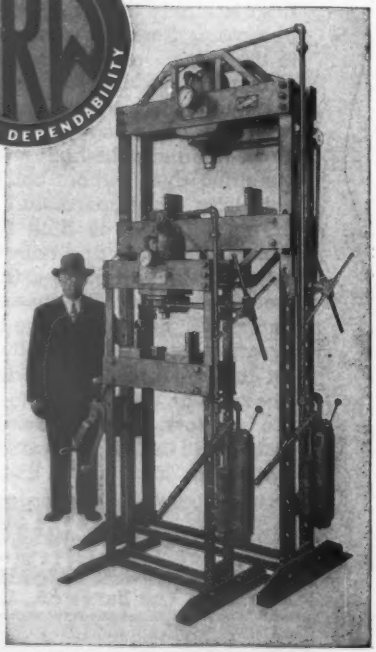
KRW HYDRAULIC ARBOR PRESSES



Engineered for War Production

★ ★

Illustration below shows a special extra high 75-ton KRW Hydraulic Arbor Press in comparison with the standard 25-ton unit.



With standard KRW Hydraulic Arbor Presses as a work-proven basis, we have been able to speedily design and build many special presses for war production—without time-consuming engineering delays. The net result has been a greatly accelerated production of vital equipment which is helping to speed the day of Victory.

As an example: The large illustration shows a special, 4-man operated, air-oil press which is used extensively for bomb loading. Hundreds of these units are now in operation.

KRW also builds standard Hydraulic Arbor Presses in 25, 50 and 75-ton capacities in addition to bench-type Arbor Presses in 1/2, 1 and 3 ton capacities. If you have a problem that an arbor press might solve, talk to us. The facts concerning many successfully-solved production applications are available in our files.

K. R. WILSON
10 LOCK ST., BUFFALO, N. Y.

SAVE PRODUCTION TIME

with a

SHOPLIFTER

One man can handle heavy dies alone. Not necessary to stop other machines to get help.

MORE production per day from your machines if a Shoplifter is handy to do the heavy job of moving dies from storage racks to the press. In these times when maximum production of machines is of vital importance, much time and labor can be saved if the operator can handle the heavy work of changing dies without calling for help from other operators.

The Shoplifter is built for this job. Dependable and safe with a rated capacity of 500 lbs. (heavier machines up to 5000 lbs. can be furnished). Entire machine built of structural steel. Electrically welded throughout. Platform lifts 54" above floor and lowers to within 5½" of floor. Overall height 72". Size of platform 24"x24" wood deck. Crank, up and down, hoist unit.

Price

$147.50

ECONOMY ENGINEERING CO.

2659 W. Van Buren St., Chicago

IMMEDIATE DELIVERY

Keeps 'Em Punchin'!

Excessive wear on a punch used in the production of washers for war equipment, held down the output below the specified production rate. The punch, with an outside diameter of 0.741" and an inside diameter of 0.325", was plated with 0.015" of hard chromium. As a result, production was boosted to a large percentage above the specified rate, the life of the tool increased beyond its normal working life, and the quality of the product stepped up.

Keeps 'Em Flyin'... *SAFELY!*

The excessive take-off speeds of the modern fighter plane require firm interlocking of the tailwheel assemblies, consisting of a flange and knuckle. The continued action produces excessive wear, causes the parts to perform improperly and endangers the life of the pilot. Since it is impossible to know just when this wear has become excessive, without complete overhaul, the manufacturer plates the assembly with hard chromium to a thickness of 0.0005". As a result, wear has been reduced to a minimum, frequent replacement eliminated, and another hazard to our fighting pilots removed.

• The working life of drills and reamers extended as much as 400%... milling cutters 25% to 300%... taps 50%... counterbores and slotters 150% ... by the application of a few thousandths of an inch of hard chromium plating! That's the experience of one of America's largest war plants.

• Hard chrome plating of worn-out tools and undercut parts ... dies, molds and gauges ... is becoming a common practice in hundreds of leading industrial plants. *Boosts production, saves precious man-hours and conserves essential tool steels by reducing wear on equipment and parts, increasing tool life, maintaining accuracy of gauges and tools and reducing corrosion and scoring.*

Specify **ADVANCE**
HARD CHROME PLATING

Our engineers will be glad to study your shop problems and suggest plating operations that will cut tool costs, increase production, keep rejects at a minimum, and conserve equipment.

WRITE, WIRE OR 'PHONE

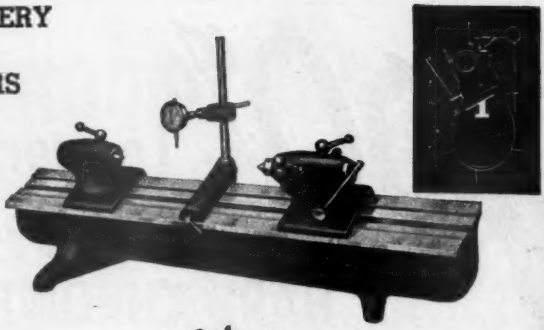
HARD CHROME DIVISION
THE ADVANCE PLATING COMPANY
395 E. 131st Street • CLEVELAND 8, OHIO • Tel. GLenville 6742

APCO

PROMPT DELIVERY
of Streamlined
BENCH CENTERS

3 Sizes
8" x 36"
6" x 24"
4" x 10"

Also available with riser blocks to increase capacity



"IN TIME OF ~~PEACE~~ *War* PREPARE FOR ~~WAR~~ *Peace*"

Where can you make a better investment right now, when war production is vital, and for the future, when peace promotes competitive problems, than in American tools and gages to speed production?

American Bench Centers are an improved design. Box section bed supported on three feet—always sits solidly on bench. Inclined face allows more room for operator's hands—prevents misuse as "catch all" for tools. Both heads adjustable and locked by clamping lever. Spring operated foot stock on larger sizes—retracting lever permits removal of work without changing adjustment. Special gaging fixtures designed to meet special checking requirements.

AMERICAN THREAD CHECKER

Checks threads on pitch diameter to "tenths". Takes work up to 5 in. diam. Furnished with ¾" x 4" anvil or 3¼" x 6¼" platen. Special anvils and platens available to meet your requirements. Recommended and used by both manufacturers and users of thread grinding equipment.

Send for Bulletin 43-TDJ for further details and data on American Amplifying Gages, Hole Checkers, Radius Dressers, Lapping Plates.

THE AMERICAN GAUGE CO.
125 Bayard Street **DAYTON, OHIO**

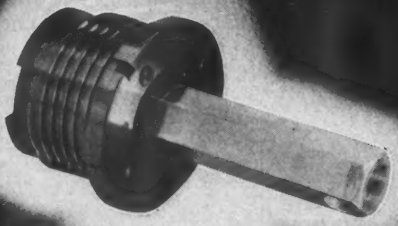
RUGGED
When it comes right down to "brass tacks", rugged construction and speedy operation are the most vital features of any milling machine. You get BOTH with the famous KEMPSMITH — industry's better milling machine since 1888.
KEMPSMITH MACHINE CO., Milwaukee, Wis, U.S.A.
MAXIMILLER
KEMPSMITH

PRECISION GAGES

produced by skilled craftsmen assuring the finest work to meet the most rigid specifications. Our modern facilities are among the best. A complete air-conditioned inspection laboratory enables us to build special tools and gages to your specifications, *exactly*. Send blue prints for immediate quotation and delivery schedule.

JIGS AND FIXTURES are a specialty. Prompt deliveries can be made to firms with high priorities. Work up to 24" can be made with precision accuracy.

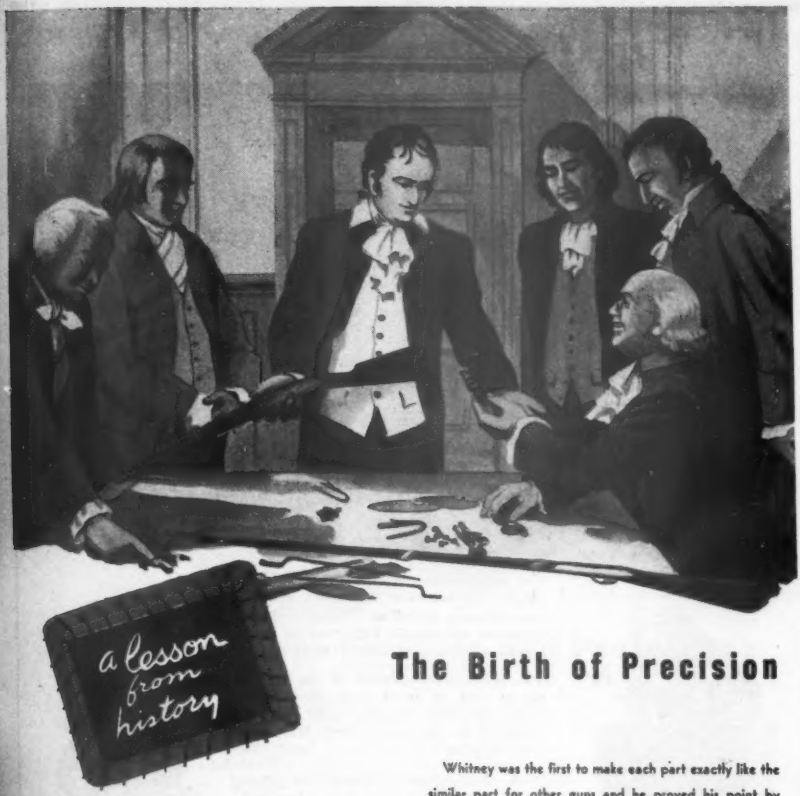
THREAD GRINDING facilities are available to manufacturers with war orders. Write or wire today for delivery dates.



TOOLS & GAGES, INC

5112 EAST 65RD STREET • CLEVELAND, OHIO

ARMY E



The Birth of Precision

● Any schoolboy can tell you what Eli Whitney did for Southern agriculture with his cotton gin. But did you know that this pioneer Yankee craftsman might properly be called the father of modern precision manufacture?

Financial failure of the cotton gin sent Whitney's American ingenuity to work on the manufacture of muskets. Up to that time, each gun and every one of its separate parts were individually shaped. No two parts were alike and if one piece was damaged, a gunsmith shaped a new one from raw stock and filed it until it fitted.

Whitney was the first to make each part exactly like the similar part for other guns and he proved his point by taking ten pieces of each part of a musket to Washington with him when he went in quest of a government contract. While bewigged officials looked on in amazement, he picked parts at random from the heap and put together ten muskets. Incidentally, he won a contract.

We say incidentally, because what Whitney did that day in 1798 gave birth to modern precision — the same precision that is found today in the manufacture of LeBLOND LATHES. Now, 145 years after Whitney's historic trip to his nation's capital, that same precision is a major factor in winning the war.

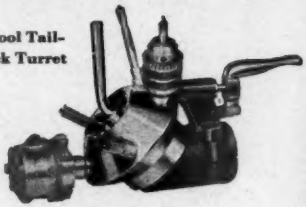
THE R. K. LeBLOND MACHINE TOOL CO. • CINCINNATI, OHIO

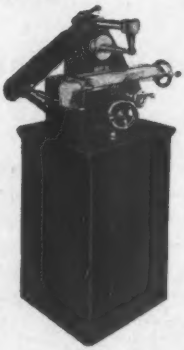
Largest Manufacturer of a Complete Line of Lathes

Photo above shows Jefferson Turrets on 16" lathe

Convert YOUR ENGINE LATHE INTO A TURRET LATHE IN 15 SECONDS

5-Tool Tail-Stock Turret





Yes, it's as easy as that! You simply attach the Jefferson Tail-Stock Turret, the Jefferson Tool-Post Turret, and the Jefferson Adjustable Pull Feed to your lathes as shown in illustration, above.

The productive capacity of these machines will be more than doubled in many instances because there will be available at all times NINE DIFFERENT TOOLS.

With these three JEFFERSON time-saving devices attached to a lathe, any kind of work may be done, such as forming, roughing, boring, finishing, knurling, drilling, tapping, etc., without stopping the lathe, or changing tools. THE JEFFERSON TURRETS are made very substantial, rigid, accurate and in several sizes to fit small bench lathes up to 24" swing.

Pat. Pending

4-Tool Tool-Post Turret

We also Manufacture the Jefferson Bull Dog Precision Milling Machine. Obtainable Power or Hand Feed.

Jefferson Turrets are real production tools — substantial, rigid, accurate and adaptable to any size or make of engine lathes. They must not be confused with the small makeshift gadgets now on the market.

TURRET DELIVERIES IN 6 DAYS

Write for further details of these and other Jefferson time-saving machine tools and machinery.

JEFFERSON MACHINE TOOL CO.
710 N. Fourth St., Cincinnati, Ohio

Tool-Post Turrets, Tail-Stock Turrets, Adjustable Pull Feeds, Belt Sanders, Gyratory Foundry Riddles, Overhead Swing Frame Grinders, Milling Machines, Dividing Heads and Vises.

a coolant transfusion...

Here's a Gray-Mills model H-10A giving high efficiency Coolant application service.

...to increase Tool Life and Production

GOOD machines can be made to do a better job by giving them a Coolant "Transfusion." And the simplest, most efficient way to apply these production-increasing, tool-saving coolants is with Gray-Mills "Controlled Flow" Portable Coolant Systems.

Gray-Mills Systems have increased the efficiency of hundreds of machines on operations like drilling, milling, sawing, grinding, honing, tapping, threading and cutting. They are quickly and easily set up to operate either as a permanent or temporary part of a tool. Sturdily built Gray-Mills Coolant Systems are available in both gear and centrifugal types, with capacities from 50 to 2,000-gal. per hour—controlled flow. Prices range from $39.50 to $189.50.

If you want to modernize your older machines—equip small, large or special tools for greater efficiency—or have a "standby" and "cleanout" system there is a Gray-Mills for the job. Call your distributor or write direct.

GRAY-MILLS CO., 211 W. Ontario St., Chicago, Ill.

STANDARD HEAVY DUTY "A" SERIES—with large capacity tanks incorporating baffles and screens. Capacities up to 165 gals. per hour —pressure, 50 lbs. p.s.i.

MODEL "G" SERIES—capacities up to 130 gals. per hour — pressure, 30 lbs. p.s.i.

PROMPT DELIVERIES

Send for the new Gray-Mills Catalog—it gives full details.

. . . complete portable coolant systems

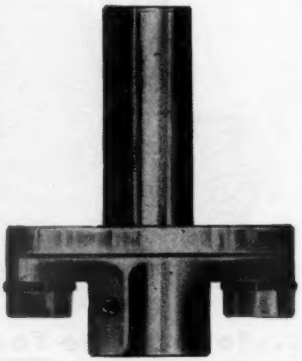
Use GRAY-MILLS Flo-Bac COOLANTS . . . 5 types for most requirements—10 and 55 gal. containers—immediate delivery from your distributor or our plant

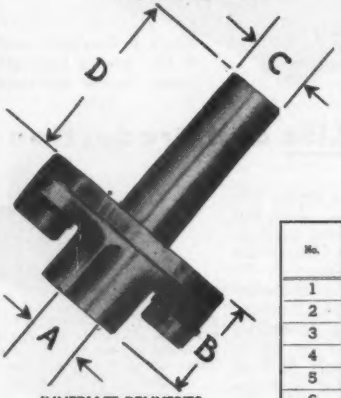
FLOATING HOLDERS

for

SCREW MACHINES

Made of forged steel and finished to precision tolerances — they are excellent for holding drills, reamers and counterbores in the turret of automatic and hand screw machine, allowing the tool to float for concentricity with the work. Quickly interchangeable for smaller tools by the use of bushing blanks.





IMMEDIATE DELIVERIES
ON PRIORITY

Specifications

No.	A Diameter of Hole for Tool in Inches	B Length of Body in Inches	C Diameter of Shank in Inches	D Length of Shank in Inches	Price Each	Bushing Blank Price Each
1	½	27/32	5/8	1⅛	$ 6.00	.55
2	5/8	1⅛	¾	2	6.25	.55
3	1	1½	1	2½	7.95	.65
4	1	1½	1¼	3	8.65	.65
5	1½	2 19/32	1½	3¼	15.00	.85
6	1½	2⅝	1¾	3	20.00	.85

AJAX ENGINEERING & MFG. CO.

Designers and Builders of Fine Machine Tools

1947 EAST KIRBY — Telephone PLaza 2336 — DETROIT, 11 MICHIGAN

NEW METHOD FOR LAPPING CARTRIDGE DIES with Reciprocating Tool

A new and perfected method of lapping cartridge dies has been developed. This is accomplished by the use of a diamond wheel, mounted on a spindle which is held in the chuck of our reciprocating tool. The tool is then mounted in a cradle which sets on the bed of the machine. By throwing the switch on the riciprocating tool will then give approximately 1,200 strokes per minute. This reciprocating action, combined with the rotating motion of the die, which is held in the chuck of the machine gives the desired lapping operation. In addition to the reciprocating action of the tool itself, an oscillating motion is also obtained when the tool moves on the bed in a forward and backward motion.

A typical setup for the fine finishing of dies is shown herewith. A 500 grit Norton diamond resinoid wheel is used. This wheel does not revolve, and is applied in the same manner as a honing stick with light pressure.

The device operating the wheel is our Portable Electric Honing Tool which gives the reciprocating action, and has a 1/8" stroke.

By this finishing method, plants have been able to obtain surface finishes better than 3 micro-inches R.M.S., in a matter of a few minutes. It is the combination of the rotating and reciprocating motions that gives this fine finish in such quick time.

Write for Additional Information

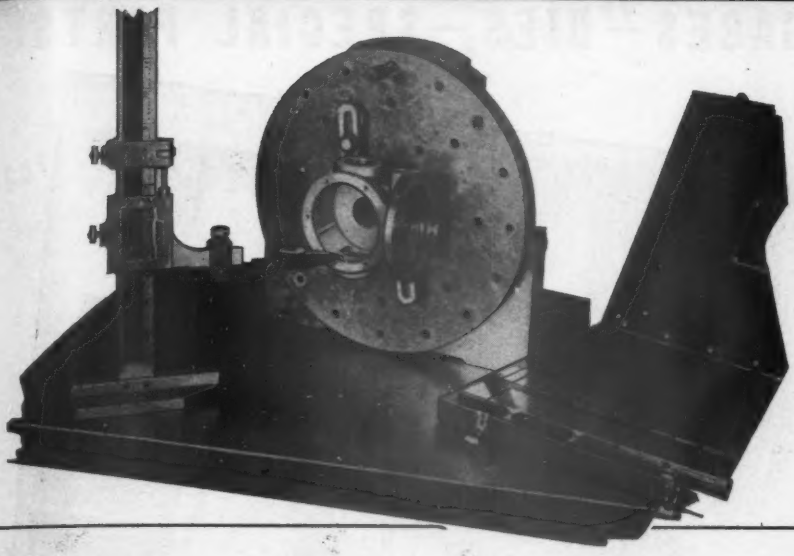
ACME TOOL COMPANY 196 CHURCH ST. NEW YORK, N. Y.

Custom Made through our *controlled trial plan*, NUBON grinding wheels and stones are engineered to meet the most exacting requirements of War Production.

Speedy Delivery — made possible by our special bonding process — not only saves vital man-hours but also enables us to quickly solve your toughest grinding problems. Send for *your* copy of our new catalog.

UNIVERSAL WHEEL & ABRASIVE CORP.

2626 Van Buren Street, Chicago, Illinois



A PRECISION UNIT FOR PRECISION WORK

Whatever the part — aircraft, navy or ordnance — you can be sure that the BECKER INDEX MASTER accurately and speedily determines its conformance with drawing specifications. No wonder many of the largest production aircraft plants have reordered it time and again — its dependable and accurate performance is needed on the production battlefront.

Comparing the present methods used in the inspection and layout of tools and parts where a bevel protractor sine bar must be set for each dimension, you can readily see the great advantage of using the BECKER INDEX MASTER—which saves valuable time.

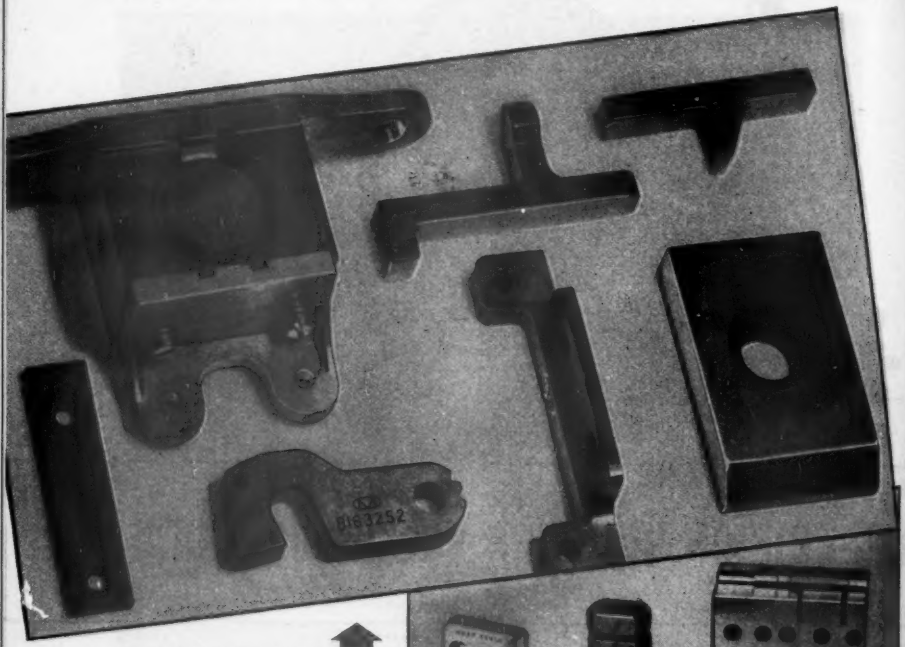
Designers and Builders of Tools, Dies, Special Machines and Parts

From our Designing and Engineering Department to our final inspection, our facilities in equipment and manpower have been built to render exacting precision service. Send for circular illustrating our facilities.

The new descriptive circular on the BECKER INDEX MASTER is now available. Send for your copy today!

THE BUNELL MACHINE & TOOL COMPANY
1601 East 23rd Street. CHerry 0343. Cleveland, Ohio

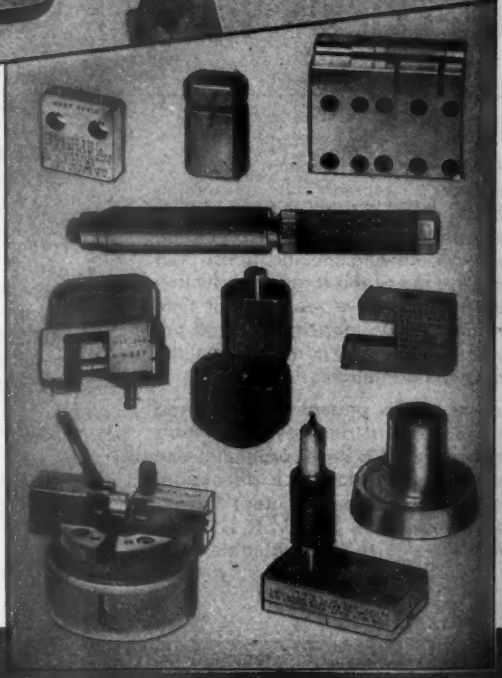
GAGES — DIES — SPECIAL PARTS



Gun and Instrument Parts, in production quantities, and to extremely close tolerances have long been made by us. These are entrusted to us because we have proved that we possess the capacity — machines and highly trained, skilled personnel necessary for this important work.

Designing and Building Gages, Dies and Fixtures is our job, and we enjoy the confidence of many of the foremost users of such tools. It is our organization of skilled mechanics that earns that confidence.

You may have a problem involving the quantity production of Special Parts, or Tools. If so, we can be of service to you.



FEDERAL TOOL CORPORATION

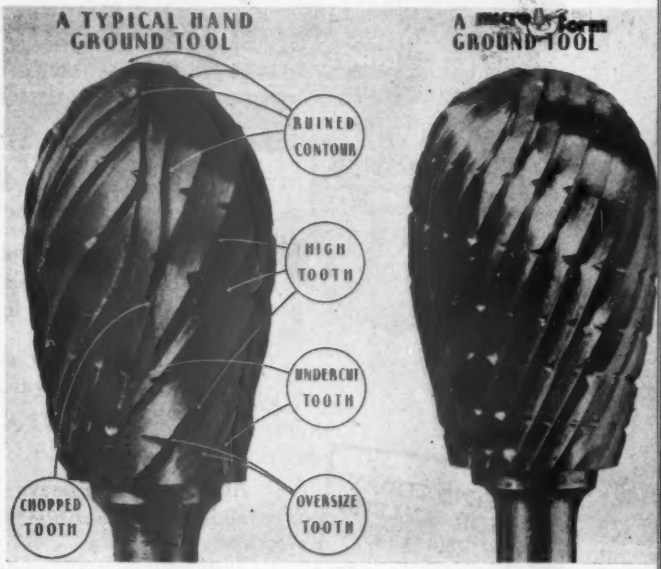
400 North Leavitt Street — CHICAGO, ILLINOIS

ROTARY FILE REGRINDING AND REBUILDING

The primary cost of using rotary files is the labor involved in their use. The finest regrinding job makes possible the lowest over-all cost and also is responsible for greater output and efficiency.

Do not expect maximum production in your plant from poorly reground rotary files. Demand micro-form contour grinding.

For all sizes and shapes of the new micro-form contour ground rotary files, send for our latest catalog.



NET PRICES

Measure largest diameter and cutting length and locate on following charts. Price is same regardless of tool shape or by whom manufactured.

REGRINDING CHART

Diameter	Cutting Length ¼"	⅜"	½"	⅝"	¾"	⅞"	1"	1⅛"	1¼"	1⅜"	1½"	1¾"	2"
⅛"	.19	.20	.21	.23	.23	.24	.26	.26	.28	.29	.31	.33	.36
3/16"	.20	.20	.22	.23	.24	.25	.26	.27	.29	.30	.32	.34	.37
¼"	.20	.21	.23	.24	.25	.26	.28	.29	.30	.32	.33	.36	.39
5/16"	.24	.25	.26	.28	.29	.30	.32	.33	.35	.36	.38	.41	.44
⅜"	.28	.29	.30	.32	.33	.35	.36	.38	.39	.41	.43	.47	.50
7/16"	.35	.37	.38	.40	.41	.43	.44	.47	.49	.51	.53	.58	.62
½"	.43	.44	.46	.47	.49	.50	.53	.55	.58	.60	.63	.68	.74
9/16"	.50	.52	.54	.56	.58	.59	.62	.65	.68	.71	.74	.80	.86
⅝"	.58	.59	.62	.64	.65	.68	.70	.73	.77	.80	.83	.90	.98
1"	.66	.68	.71	.73	.75	.77	.80	.83	.87	.91	.95	1.03	1.11
1⅛"	.74	.77	.79	.81	.84	.86	.89	.94	.98	1.03	1.07	1.16	1.25

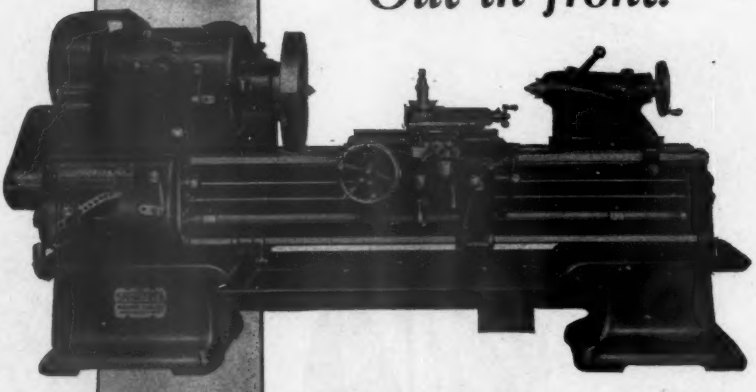
micro-form CIRCULAR GRINDING "THE STANDARD OF THE INDUSTRY"

RESEARCH TOOL COMPANY

Saginaw, Michigan

SPRINGFIELD PRECISION LATHE

Out in front!



● Headstock . . . twelve speeds . . . only half of the easy-shifting spur gears mesh at one time.

Motors . . . V-Belt or silent chain drive. Bed . . . permanently true—made of high test alloy to resist warp or marring under severe service.

Apron . . . extra heavy—operates on Ball and Bronze bearings throughout.

Taper attachment . . . hair-trigger adjustment.

Compound rest . . . sturdy, firm.

Tailstock . . . all bearings and bed ways oiled from one well.

From headstock to tailstock—the SPRINGFIELD Lathe is *out in front!*

SEND TODAY FOR BULLETIN No. 163

Tells the why and how of Springfield's accurate production.

THE SPRINGFIELD MACHINE TOOL CO.

SPRINGFIELD • OHIO. U. S. A.

Immediate Delivery From Stock

480
For Logan
Turret Lathe
etc.

LEVER-TYPE
Makes Obsolete
All Existing Models

Patent Pending
Infringements
Prosecuted

Precision Collets and Drawbars

For 10" Atlas & Logan, 9" South Bend ½" Capacity Lathes

It pays to specify *Precision* when collet work is indicated. Guaranteed unconditionally *Precision* products not only meet exacting standards of excellence, but may be had for immediate delivery.

And be sure to ask your dealer for the new *Precision* Lever-Type Drawbar. Practical men in the machine shops find it simpler to install . . . no holes to drill or tap . . . and built for superior performance. The sensational Coordinate Cam principle eliminates the need for bearings and fingers, resulting in easier operation and lasting construction. *Literature on request.*

HAND
TYPE

3AT

GENERAL DIE-STAMPING-TOOL COMPANY

PRECISION COLLET DIVISION 265 Canal Street, New York 13, N.Y.

BULLETS FOR MEN

FROM Alaska

TRAMP, tramp, tramp—the boys are marching—all races—all creeds—all colors—all nationalities—backed by the ever-growing might of the United Nations.

In battle, that might depends on the effectiveness and accuracy of the bullets which are the final savage bite our warmen give.

Hair splitting accuracy must prevail in the manufacture of these bullets. Otherwise the gun may jam and spell disaster for the gunner.

At Ohio Tool, our job is to be sure that the tools we produce for the making of bullets are accurate—accurate by as much as 1/30 of the thickness of a human hair.

To achieve this accuracy on a quantity production basis, hundreds of skilled workers have been trained to operate specialized machinery for the exclusive purpose of producing tools and dies for the ceaseless stream of small arms ammunition that goes to fighting men everywhere.

OHIO TOOL COMPANY

CLEVELAND, OHIO

Manufacturers of small arms ammunition tools, precision, hardened and ground parts; also accurate aircraft parts and assemblies.

DESIGNERS AND BUILDERS OF TOOLS, DIES, JIGS, FIXTURES, GAGES AND SPECIAL MACHINERY

Telephone your ◆ FIRST

What would *you* do, if you found at 4 p.m. that your assembly line was running out of critical parts—with the manufacturer 500 miles away?

Right! You would telephone your ◆ Industrial Supply Distributor *first*. And it's a fair break that he might be able to deliver from stock—or could "beg, borrow or steal" enough to keep you going until his next shipment came in.

It's a vital part of your Industrial Supply Distributor's business to know what materials you must have to keep your operations on schedule. He orders ahead for you and all his other customers. He buys on priority—he buys as much as he can—he buys as often as he can.

Why not simplify *your* purchasing in these short-handed times? Order from your Industrial Supply Distributor—check with him ahead of your needs. The chances are he will say in effect:—"sure—that stuff is coming through from the factory by truck—*tonight!*"

The CLEVELAND TWIST DRILL COMPANY
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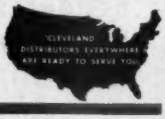


ACHIEVEMENTS BRING RESPONSIBILITIES

FOR several months now American Industry has been hearing its achievements referred to in glowing terms which may be epitomized in the expression—the modern miracle of production.

It will be remembered that not many years ago Industry came in for no small amount of criticism for its failure to maintain employment at a normal level during a period of rapidly declining demand.

Less than two years of unprecedented war production have changed all of that and today American Industry stands at the very pinnacle of accomplishment. As with an individual, when praise becomes almost universal, it is the time to guard against the tumble which may follow the unguarded thought and action induced by pride of performance.

Recently both the President and the Vice President have delivered addresses which, in their significance as Administration utterances, cannot be lightly dismissed by the industrialist. The Vice President told us that vision and daring will be needed to successfully bring about an orderly transition from the war economy to that of peacetime.

And there was the President's War Report to the Nation. Perhaps you listened to it as he radiocast it and were duly impressed with its recital of our accomplishments to date but dismissed the portions of it that had to do with industrial re-conversion and our obligation to our soldiers when they return to civil life, as problems to be considered and solved as and when they reach us. If you thought of the President's suggestions in terms of their application to businesses other than yours or to plant operators other than you, you have underestimated the importance of what he said.

It is evident that the Administration is looking to and confidently expecting American Industry to again bat out the home runs which will win the game. Therefore, it is safe to say that American Industry never has had as much at stake as it will have with the ending of the war. Unlimited opportunities will abound, but with them will come responsibilities as great as any we assumed when we undertook to achieve the war production goals of 1942-43.

With the war's end, the individual industrialist will indeed have need for straight thinking. He must effect the orderly conversion of his own business to a peacetime operating basis. This will involve the re-establishment of all activities from planning to production, from buying of raw materials and parts to selling of finished products. Employment and training will begin anew. All of this before demobilization becomes heavy.

With demobilization in larger volume will come an entirely

new set of conditions and responsibilities. Our men must be drawn back into industry rapidly and without confusion. Many of them will have new skills, some will have lost the old, all will have to get into the swing of the industrial techniques and out of the military.

The manufacturer and shop operator will be called upon to absorb the costs incident to reconverting his business, his tax burden will continue to be heavy and, in addition, he will pay his share of the demobilization expenses which, according to current estimates, will be very large, probably well up in the billions.

But why doubt the ability of the industrialist, individually, and of American Industry, collectively, to solve this re-conversion problem any less efficiently than they did that of wartime production? From every standpoint the road to peacetime goals should be more attractive. All of our thinking, planning and action will be looking to the *constructive*, not the destructive, and there is no logical viewpoint from which any man can find fault with raising the standard of living for other men, women and children, regardless of whether they are fellow Americans, British, Russians or Chinese.

With the war's end American Industry must have new customers because Uncle Sam should be getting out of the market. Here at home with large savings and commercial deposits looking for spending outlets, we will have a huge pent-up demand for necessities, conveniences and luxuries. In other parts of the world there will still be a longing just for the necessities of life.

It is not to be denied that the nations of Europe have for years been suspicious and envious of each other and that these human traits set up a difficult problem. It is probably doubly difficult to win the confidence of a people we have just pounded into submission. But like the impossible in our war production it will take just a little longer. For, if you help a man to help himself there must eventually come the spark that kindles into the warm glow of gratitude.

Other characteristics of the American Industrial organization must be evident. It has the world's largest production plant. It has skilled and trained workers by the million. It has natural resources in abundance and if or when these begin to diminish, it has the great genius of its people to fall back upon. Someone has said that inventive daring illumines their genius, and adventurous ardor invigorates the work of their hands. If American Industry sees to it that Government provides the cooperation and guardianship essential to a sound free enterprise system, American capital, management and labor together will carry the burden of reconstruction and achieve for the peoples of the world greater blessings than they have ever known.

Editor and Publisher

This message comes from Washington where Mr. Huebner is serving as Chief of the Tooling Branch, Facilities Bureau, War Production Board.

PRESENT STATUS OF POWDER METALLURGY

Introducing a series of articles on the application of powdered metallurgy and its manufacturing techniques

PARALLELING the increased use of plastics to offset the enormous demands for materials by the war industries, American engineers are finding an important avenue for their resourcefulness in the technique of powder metallurgy.

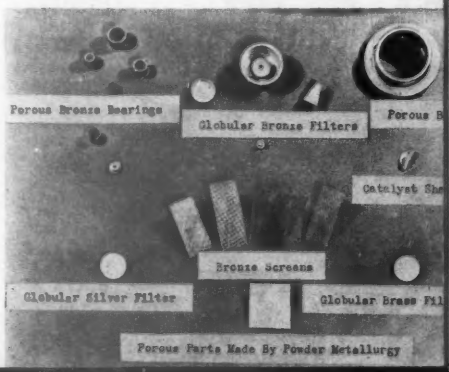
This is not a new process. But within the last two years industry has begun to find out how adaptable it is for a wide range of uses. Almost a quarter of a century ago metallurgists found that metals like tungsten and molybdenum, which were difficult to cast because of their high melting temperatures, could be readily shaped if first converted into powder and then resolidified under great pressure. Most successful of the early tests provided the tungsten filaments of electric lamps.

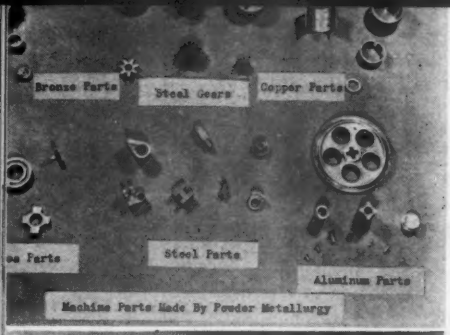
Recently the process has been extended to common metals, which in powder form are fed into dies and molded into articles such as airplane pump gears and other parts. These articles can be produced in this fashion without the metal loss that occurs in casting or the necessity of high cost machining.

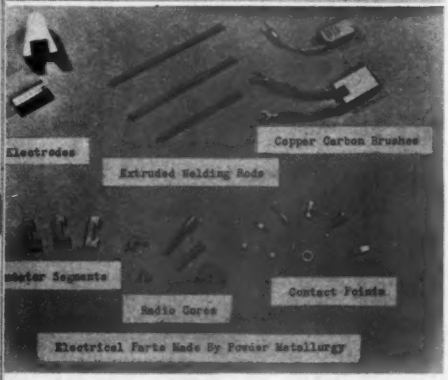
Some metals, of course, are difficult to fuse in a metal state and these can be mixed as powders. Copper-lead bearings are an example. Automotive engineers have been particularly interested in powder metallurgy because it enabled them to produce bearings which could be impregnated with lubricants. In effect, the bearings were given a built-in oil system, the oil oozing forth when needed.

As these bearings demonstrated themselves capable of outliving the average life of an automobile, the engineers began to look on them in a new light. And in the present emergency their use represents a great contribution. The most important recent development has been to fabricate metal products formerly made by die-casting metals. Application of the process has saved months in making retaining rings for ball bearing used in anti-aircraft guns and airplane propeller parts.

The process has been likened by one metallurgist to a cooking recipe. "With powder metallurgy," he said, "you decide what kind of 'soup' you want and you confect it out of pure ingredients according to a scientific recipe. If your soup is, say, a gear, you determine its exact size, shape and composition. Then you get your ingredients together—powdered pure iron of the exact fitness required, plus whatever additional materials you need, such as nickel, chromium or graphite. You weigh them and blend them and after they are properly mixed you dump them into steel dies, give them just the right amount of pressure, heat



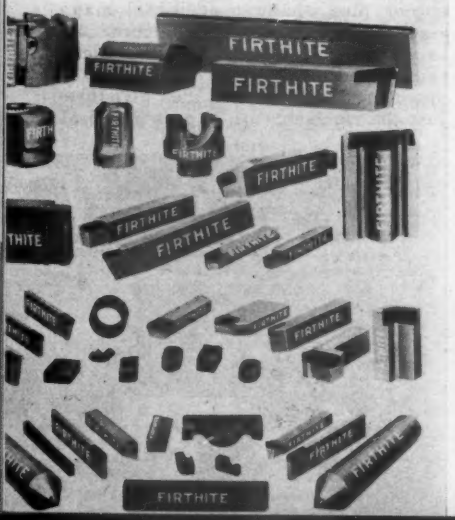




—and you get this!"

The metallurgist shoveled a scoop of powder into a hollow in the table of a hydraulic press. A plunger entered the hollow and rose, followed by a perfect gear.

It seems almost a matter of course to the non-expert that the metallic parts



encountered in his daily life or in the technical field, have passed through the stages of melting and casting before receiving their final shape and even experts often wonder as to the reasons which have been behind this new development in the field of metallurgy. A brief historical review will give an answer.

At the beginning of the nineteenth century, attempts were made at putting to technical use such high-melting-point metals as platinum and iridium. In view of the status of furnace engineering at that time, the customary methods of melting and casting were out of the question.

When making wire and sheet from tungsten at such high-melting points of 3400°, 2600° and 2900° C, much greater difficulties were encountered than in the production of platinum in powder form having the comparatively low melting point of 1770° C. Much credit for overcoming a multitude of difficulties must be given to the makers of incandescent lamps and the electrical industry in general where tungsten and molybdenum are being used in huge quantities in the form of wire, sheet and strip. Many industries promoted the further development of powder metallurgy and offered applications which today are uncontested fields of powder metallurgy and has secured it a permanent place in industry. In this connection the hard cemented carbides, the porous bearings (oil-less bearings and bushings), the porous metal filters, the carbon brushes and composite metals used as contact materials and bimetallic compositions for frictional clutches and brake facings may be mentioned.

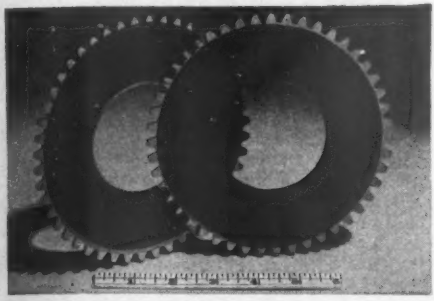
High Melting Point Metals

From chemically pure tungsten and molybdenum trioxide, a fine tungsten and molybdenum powder, as free from oxygen as possible, is prepared by reduction with hydrogen in electric furnaces.

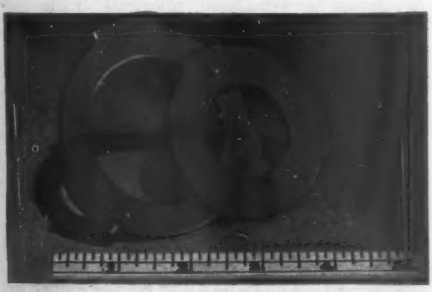
Tungsten is being used in the form of incandescent and heating filaments for electric lamps and radio tubes, also in the preparation of supports in hard glass tubes. In current rectifiers with mercury cathodes, the vacuum-tight leads for the anodes are often made of

External type brake shoes lined with Velvetouch blocks of the type used on light punch press equipment.

Below: Small sandwich type multiple disc clutch facings for replacement in Bullard Multimatics.



Multiple disc clutch facings of the type used for replacement in Morse Pulmore machine tool clutches.



Sandwich type Velvetouch machine tool clutch discs.

tungsten. In X-ray tubes, the anticathodes consist of tungsten.

In welding practice, large quantities of tungsten rods are required as electrodes in atomic arc welding equipment. It is a well known fact that in atomic arc welding temperatures of up to 4000° C are attained in the tungsten arc, in other words, temperatures under which only tungsten is able to stand up.

Similarly to tungsten, molybdenum has found wide application in incandescent lamps, vacuum amplifier tubes, transmitter tubes in high-tension rectifiers and hot cathode rectifiers, in the form of wire and mesh for heavy-duty grids; in the form of sheet for anodes, especially in transmitter tubes; in the form of rods, wires, caps or rings for vacuum-tight glass supports for the tungsten heating filaments. In X-ray tubes and high-tension valves, molybdenum is being used for supports of all types. In addition, it has found use in heating elements for electrically heated high temperature furnaces.

Among the high melting point metals, we must count also the elements tantalum and columbium. Thanks to its excellent resistance to acids, tantalum is being used in the chemical industry for spinning nozzles in the production of artificial fiber. Further applications are found in the production of hydrochloric acid, the fabrication of heat exchangers, nozzles for steam, water, oil, or acids; as protective coating for indicating instruments, pump rods and valves.

Porous Metal Parts

The application of porous sintered parts as bearings, however, is much more important. These so-called oil-less or self-lubricating bearings are porous sintered parts of powders having a relatively low melting point; their pores are filled with a lubricant. These parts are installed at such points as are not exposed to high loads and do not require much attention. As a rule, it is not necessary to connect these pores with oil lines. Most of the porous bearing parts are made from copper and tin, if necessary with an addition of graphite in colloidal distribution. At operating temperatures the oil will leave the pores and form a continuous lubricating film. As soon as the bearing cools down, the oil will be drawn back into the pores by capillary force.

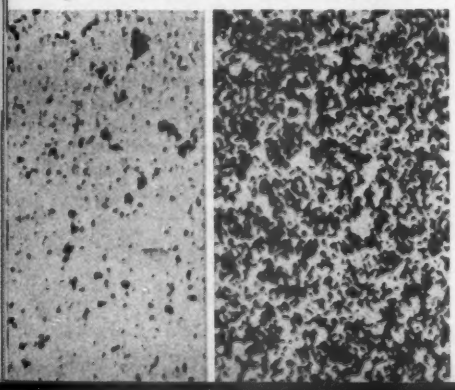
Cemented Carbide Alloys

Modern machine tools are increasingly equipped with tools carrying tips of cemented carbides, instead of high speed tools. Cemented carbides, at the present time, are occupying an important place in the shops of nearly every industry chiefly because they make possible considerable increases in cutting speed and in the out-put in general. Today, there are available suitable cemented carbide alloys for almost any purpose, be it the cutting of steel, gray cast iron, light metals, copper alloys, glass, porcelain, synthetic resins or other materials.

Modern cemented carbides are made from powdered carbides of tungsten, titanium, molybdenum, tantalum and the auxiliary metals of the Fe group, chiefly Co, by sintering. The finely powdered carbides or carbide blends are mixed with cobalt or nickel and ground in suitable ball mills until they attain a colloidally fine condition. Microsection of a cemented carbide material is shown in Fig. 10. The uniform distribution of the carbides in the binder phase may be seen very clearly. It should be mentioned here that cemented carbides are finding wide uses not only for purposes of cutting, but also for wire-drawing dies and as linings for tools especially exposed to wear, such as drilling tools, ball mills, holing picks, forge hammers, gages and the like.

9. Structure of porous bearing etched and magnified 70 times. (Left)

10. Structure of sintered carbide material etched and magnified 250 times.



Composite Metals

Composite metals are being used with great success in high-tension switches as well as low-tension switches, especially oil circuit breakers of small size.

Frictional Metal

Almost every piece of machinery has some sort of friction clutch or brake application. The S. K. Wellman Co. has developed a frictional material made from sintered powdered metals welded to steel. This material consists of a combination of various powdered metals such as copper, tin, lead, and other powdered materials, compressed, sintered, and welded to a solid metal backing for support. The powdered metal surface may vary from 0.010" to 0.25" in thickness. The brake bands on practically all airplanes are made by this technique, as are also clutches, including those which control the revolving turrets on tanks. An airplane landing at 100 miles per hour creates a temperature on the brake surface of 1200° F in eight seconds. Powder metallurgy products alone can endure such treatment.

In future articles each of the major applications will be discussed in detail. The making of metal powders, molding technique, die design and sintering will also be described.

COLD WORKING
STEEL CARTRIDGE CASES

Reported by William Halker
PLANT MANAGER
Corcoran-Brown Lamp Division
Electric Auto-Lite Company
TO ASSISTANT EDITOR, DON E. ROOT

THE May, 1943 issue of THE TOOL & DIE JOURNAL carried an article on the hot process development by the Buick Motor Company in manufacturing steel cartridge cases. Paralleling this development was the cold working process now being used satisfactorily by approximately 150 shell manufacturers.

With the difficulty in securing sufficient copper to produce an adequate quantity of brass cartridge cases, the Corcoran-Brown Division of the Electric Auto-Lite Company began experimental work on the manufacture of a case produced entirely from steel. Even as early as the first World War, German engineers attempted to produce a steel case using several pieces. As far as can be learned, these did not prove successful. While Corcoran-Brown experimented along this line and had some success with welded steel cases in 40mm, 75mm and 105mm sizes, they were not entirely satisfactory.

Discussed as a possibility was the drawing of the case in a single piece. There was, however, no background or precedent for such procedure. Using a blank cut from an old plating tank, the company produced a 37mm case and proved it was possible to produce a single piece case if the steel were copper plated. Worthy of particular note is the fact that the copper plating on the blank eliminated all scoring with the copper actually reducing itself in thickness through the various steps of the draw.

While it was proved that a steel case could be produced, it must be admitted that it failed in ordnance tests. This failure was attributed to the unknown steel that was used. In cooperation with the American Rolling Mills, a special steel was developed. Censoring prevents our listing the properties but they can be obtained by writing directly to the company in Cincinnati, O. On October 15, 1941, cold drawn and heat treated fabricated cases were proof fired successfully at the Aberdeen Proving Grounds. The first manufacturing technique included six draws after the formation of the conventional cup. The cases were annealed after the cupping operation, the second redraw and the fourth redraw.

They were also given a stress relieve anneal after completion. An experiment of interest at this time concerned the possibility of avoiding eccentricity of the walls of the cartridge cases caused by slippage of the blank and contacted by the cupping punch. Efforts were made to insure concentricity by forming annular rings on the inside base section of the pieces. It was found, however, that these rings produced a fold or cold chute in the base section of the finished case.

Firing tests demonstrated that the cases were thereby weakened with rup-

tures resulting. The slippage difficulty was partially eliminated by a sizing of the blank to true up the edges. Also important is the experimental work done by the company over an extended period of time in determining the most efficient tool steels for each die and tool required in the production of steel cartridge cases. These tests were carried out with die rings made of tool steel, each of which was nitrided and once correct die sizes were determined, cemented carbide die rings were substituted.

Considerable difficulty was experienced in obtaining a drawing compound that would eliminate scoring and scratching. Working with engineers of Gilron Products Company, Cleveland, O., they developed a soap base compound that completely eliminated scoring. This coating was placed on the cups prior to drawing and coating the case between each draw. This compound not only eliminated the need for copper plating but also reduced the number of drawing operations from six to five.

It is important to mention thorough tests undertaken by the company in relation to the use of round bar stock for the cutting of blanks. Although recommended to Corcoran-Brown by several sources, experiments conclusively demonstrated to the company that this type of blank is unsatisfactory for the fabrication of cold drawn cups. The tests revealed that spheroidizing of the metal does not break up the directional grain structure produced in the rolling process to a great enough extent to create the necessary strength for the cold cupping operation. For that reason the cutting of blanks from round bar stock has not been used by Corcoran-Brown.

It soon became evident that some sort of protective coating other than copper plate would be necessary due to the ever growing seriousness of the copper situation. Specifications set up by Ordnance indicated that some variety of phenolic base varnish would be necessary. Working closely with Frankford Arsenal in connection with their work on organic finishes for steel cartridge cases a substitute product (baked phenolic varnish) was developed and is now used on all size cases produced. Application of the fluid required thorough experimentation to avoid a porous finish and beading on the cartridge case rim. This latter condition was met by a deterring process using a machine adapted to the special requirements of the cartridge case problem. And as previously stated, under the lacquer method of protective coating it was no longer necessary to copper plate for rust prevention. Copper plating for this protection had previously been perfected by the company on a limited scale after overcoming considerable problems incident to holding tolerances on finished cases.

Corcoran-Brown Company is now in full production on 20mm, 37mm, 40mm, 57mm, 75mm and 105mm sizes. It was pointed out that deep drawing by this process is not only helping considerably during an emergency but also presents a great potential for post-war applications.

●

Another development in manufacturing steel cartridge cases is described to us by F. G. Gepfert, Vice-President of Black Drill Co., Cleveland, O.

Regardless of the method employed, hot forge or cold draw, in the forming of the case, certain machining operations are necessary to bring the head to shape and size. The procedure followed by one producer of steel cartridge cases (Briggs Mfg. Co., Detroit plant) is interesting from the standpoint of the ingenuity displayed by their Experimental Engineering Department in achieving high output without sacrifice of accuracy in the machining of the head.

Four machining operations are completed in the 75mm steel case in about 25 seconds on a Willsea Head Turner running at 475 rpm. Three 1-inch tool bits with "Hardsteel" tips are used. These tips, ½" x ⅝" x ⅜", are hydrogen brazed in the bits.

The tools marked A, B, and C in the photograph, Fig. 1, operate as follows:

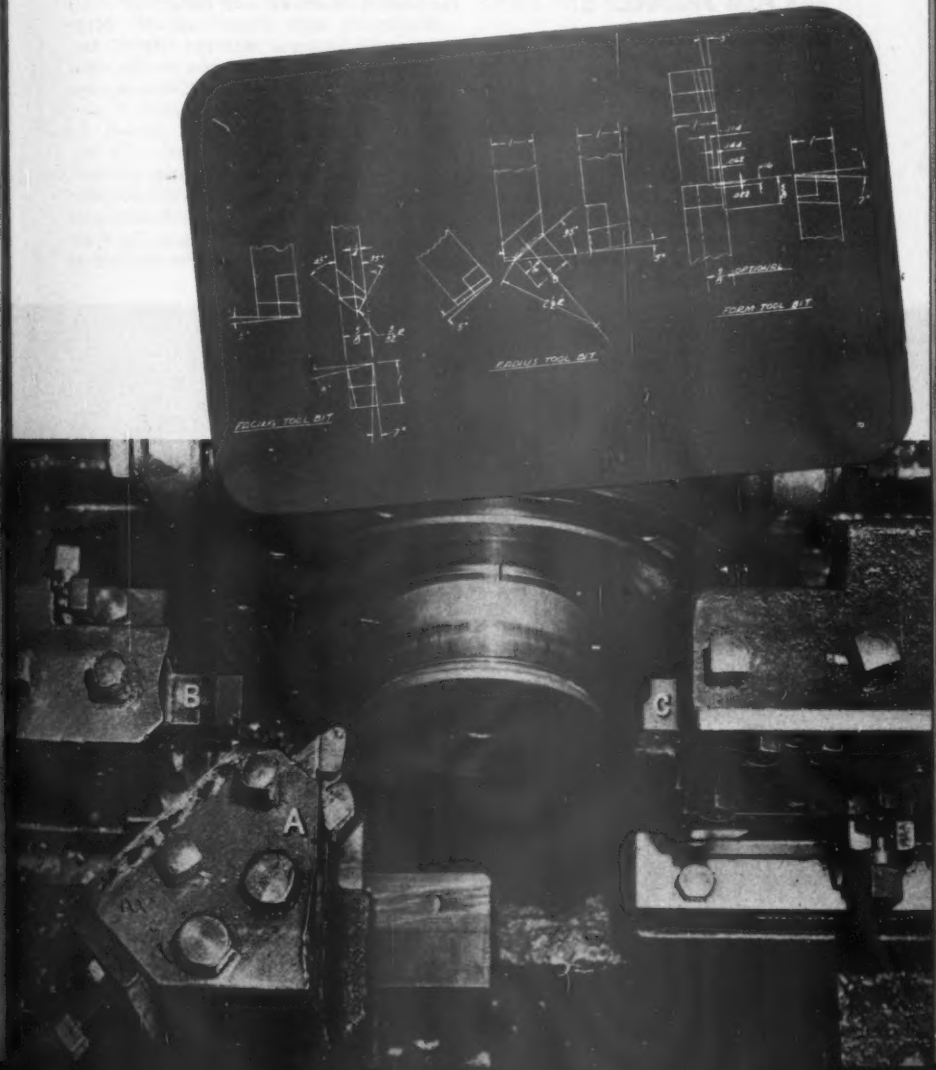
The facing tool A moves to the center of the cartridge case head, taking off approximately $\frac{1}{32}$" to $\frac{1}{16}$" of metal in the roughing cut. As A reaches the center hole, which has been pierced in a previ-

ous operation, the cut is relieved and the forming tool B comes in contact with the case and turns the extreme O.D. of the ejector flange, also the .020" shoulder, and trues up any irregularities on the body of the case within ½" of the shoulder. Then as tools A and B move back, A makes a finishing cut. At the same time C comes in and finishes the radius on the ejector flange.

Of all the tools, the radius tool bit (C) was the most difficult to design, because operation called for a plunge cut and tolerances at this point on the case were extremely close.

Average hardness of the steel is 100 B Rockwell, yet experience has shown that up to 600 pieces can be machined and still hold the accuracy required before regrinding of the tools is necessary. Women operators grind the tools and any good dry wheel has been found satisfactory for use with "Hardsteel".

Standardization of the tools and the use of jigs for grinding the tools make for speedy tool reconditioning and permit the use of any tool in any of the many machines in the production line now used to machine this company's huge output of 75mm cases. Down time consequently is a negligible factor and production is maintained at a high level.

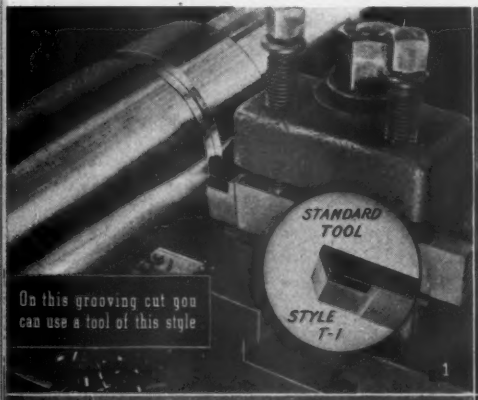


DESIGNING CARBIDE TOOLS

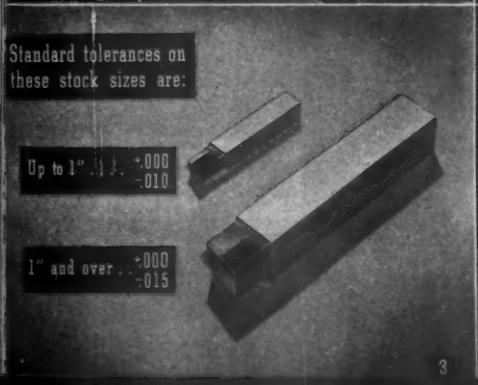
A FILM PRODUCED BY
Carboloy Company, Inc.

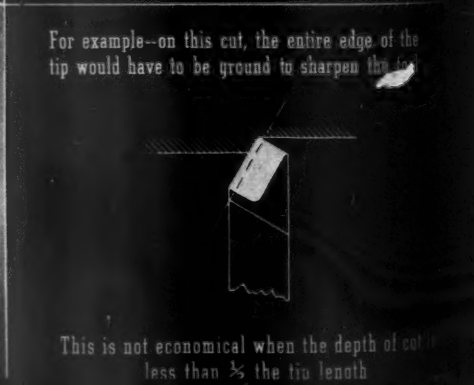
INASMUCH as multiple-point tools represent merely the simultaneous application of a number of single point tools, primary emphasis in this film is placed on the single point tool. From an application standpoint, more than 75% of the tools in use today are single point tools. From a design standpoint, single point tools illustrate every basic principle needed to design any tool.

While this type of tool appears very simple; its design is of great importance to satisfactory performance on the job. These things must be determined: a. the style of tool (straight, offset, etc.), b. the size of the shank, c. the tip needed, d. the correct tool shape (angles). In order to work out specifications on each of these points, you must know the job the tool will have to do. You must have exact information about the part, the material of which it is made, the operation



Here is a job, that calls for a heavy cut. Tool overhang is great. A large tool is needed




For example--on this cut, the entire edge of the tip would have to be ground to sharpen the

This is not economical when the depth of cut is less than ⅓ the tip length

to be performed on it, and the type of machine to be used.

Style of Tool

Tool style depends on the part, the operation and the machine, including tool holder. Different styles of standard tools would be required for taking a straight cut on an engine lathe; turning to a square shoulder; a vertical boring operation; a facing cut on a turret lathe or a grooving cut. However, whenever possible it is good procedure to use standard carbide tools and blanks rather than "specials", since the cost is less and faster delivery from your supplier is possible. Eighty percent of all turning, boring and facing jobs can be done with standard styles.

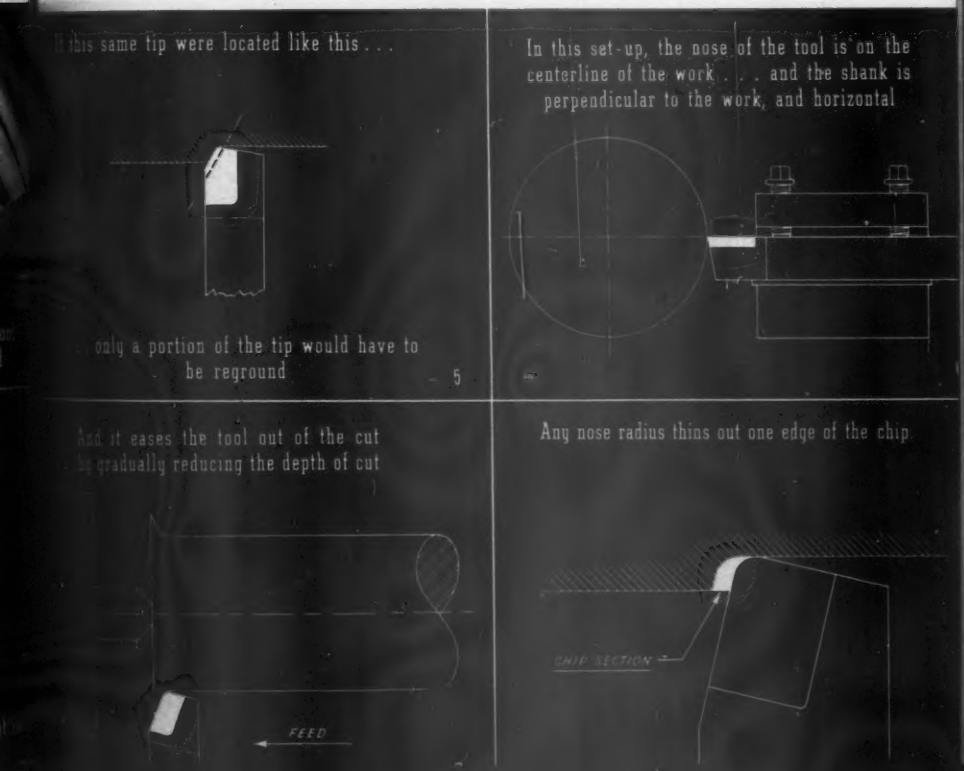
Shank Size

Shank size depends on the cut to be taken (depth of cut and feed, as determined from the part and operation) and the machine and tool holder (particularly as they affect tool overhang). On a light cut a small tool is recommended. If the cut is light, but the overhang great, best procedure is to use a small tool in a holder. When the cut is heavy and the overhang is great, a large tool is necessary. In general the shank of a carbide tool must be large enough to prevent bending and to dampen vibration. Note Table II. When making your own tools or ordering special tools use a shank of standard stock size. Tolerances are usually held to +.000 —.010 on sizes up to 1" and +.000 —.015 on sizes over 1". If closer tolerances are used the shanks must be ground to size. This is seldom necessary and only increases the cost.

Selecting the Correct Tip

Establishing the tip thickness depends on depth of cut and feed. See Table III. Next determine the tip width and length that are suitable for the job. Whenever possible avoid long thin tips. They are more subject to breakage.

Consideration should also be given to the most satisfactory and economical tip


this same tip were located like this . . .
only a portion of the tip would have to be reground
In this set-up, the nose of the tool is on the centerline of the work . . . and the shank is perpendicular to the work, and horizontal
And it eases the tool out of the cut by gradually reducing the depth of cut
FEED
Any nose radius thins out one edge of the chip
CHIP SECTION

location. For example in the cut shown in Fig. 4, the entire edge of the tip would have to be ground to sharpen the tool. This is not economical when the depth of cut is less than one-half the tip length. If this same tip were located as shown in Fig. 5, only a portion of the tip would have to be reground.

Tool Shape

Tool shape includes side cutting-edge angle, and cutting-edge angle, relief angles (clearance), rake angles and nose radius. In the setup shown in Fig. 6, the nose of the tool is on the centerline of the work and the shank is perpendicular to the work and horizontal. Taking the tool used in this setup, let's look first at its side cutting-edge angle. This angle has several important functions. It increases the strength of the nose of the tool by increasing the size of the included angle. Also the side cutting-edge angle allows the starting load to be taken at a point back of the nose, where the tool is stronger, and it eases the tool out of the cut by gradually reducing the depth of cut as shown in Fig. 7. On a simple setup such as we are discussing, the side cutting-edge angle will vary between 0° and 15°.

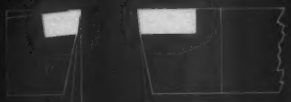
On ordinary turning and facing jobs, the end cutting-edge has a practical range of 8° to 15°. It must be large enough to clear the work and prevent drag. However, it must not be too large as this weakens the nose of the tool.

The nose radius of a carbide tool should be kept small. The following table will serve as a guide.

Depth of Cut	Nose Radius
⅛ or less	1/32
1/16–⅜	3/64
7/16–¾	1/16
13/16–1¼	3/32

Figure 8 illustrates that any nose radius thins out one edge of the chip. If a large nose radius is used with a small depth of cut, a major portion of the chip becomes thin. In steel cutting, the thin chip builds up a burr on the cutting edge. Particles of this burr squeeze between the work and cutting edge. They mar the work surface and abrade the

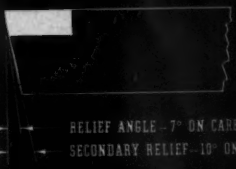
We recommend that side relief and end relief be the same



(It is difficult to grind the nose radius if these angles differ)

9

We recommend the use of double relief angles



With double angles, only the carbide tip touches the wheel when you are finish grinding or sharpening

Under these conditions, negative back rake reduces the impact load on the nose of the tool, where breakdown usually occurs first

The amount of negative back rake to be used depends on the job

11

On an end-cutting tool positive back rake is the cutting rake

It has the same effect and the same usual range (0° to 15°) as the positive side rake on a side cutting

end of the tool, shortening tool life. In machining cast iron and non-ferrous materials, a thin chip causes a rubbing rather than a cutting action also shortening tool life.

Figure 9 recommends a side relief and end relief angle for this job. In general the smaller the relief angles, the stronger the cutting edge. However, the relief angles must be large enough to prevent excessive rubbing of the tool on the work. For most jobs, end and side relief angles of 7° are satisfactory. But they may range from 5° to 12° depending on the material to be cut. Larger angles may be used safely when you are machining aluminum and copper. Relief angles of 5°–7° for cast iron, and 7°–10° for steel are normally used. The use of double relief angles as shown in Fig. 10 is usually recommended.

The side rake is the cutting rake on a side cutting tool. This is a positive rake and it determines how freely the tool peels the chip off the work. The usual range for side rake angles is 0° to 15°. When machining high strength materials, such as most steels, use a side rake of 0° to 4° for heavy cuts, 4° to 8° for medium to light cuts. For cast iron use a side rake of 4° to 8°. When machining low strength materials, such as copper and aluminum, use a side rake of 8° to 15°. In some cases it may be necessary to go as high as 25° to 35° to get a free cutting action.

When taking heavy cuts on rough castings or forgings and when taking interrupted cuts it is sometimes desirable to use negative back rake as shown in Fig. 11. When negative back rake is heavy a positive side rake is also necessary. Disadvantages of back rake are the increase in pressure between tool and work and the increase in the power required. Therefore, back rake should not be used except when needed.

On an end-cutting tool, positive back rake is the cutting rake. It has the same effect and the same usual range (0° to 15°) as the positive side rake on a side cutting tool.

CHART FOR SELECTION OF RAKE AND RELIEF ANGLES

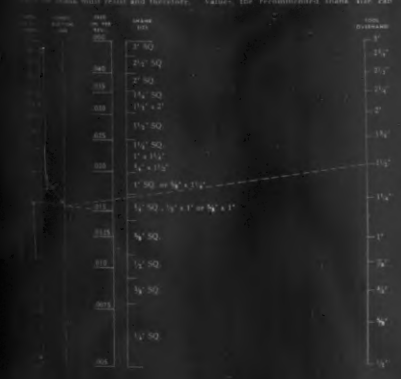
The angles shown in this table are intended to apply to jobs where the tool shank is set perpendicular to the work at the point where the nose of the tool contacts the work. A typical example of this setup is an ordinary single point turning tool set in a lathe with the cutting edge on the center line of the work. Tools of other types or tools held in other positions with relation to the work should have the angles on the tools ground to correspond to this standard setup. Use this chart in conjunction with preceding tables.

MATERIAL	SIDE RAKE: Depth of Cut Less than ¼"	SIDE RAKE: Depth of Cut ¼" or Over	Back Rake	Front Relief	Side Relief
Soft Steel Less than 200 Brinell	8° 15°	4° 12°	0° 10°	6° 12°	6° 12°
Medium Soft Steel 200-275 Brinell	8° 12°	4° 10°	0° 8°	6° 10°	6° 10°
Medium Steel 275-350 Brinell	6° 10°	4° 8°	0° 5°	5° 8°	5° 8°
Medium Hard Steel 351-425 Brinell	4° 8°	0° 6°	0° 3°	4° 8°	4° 8°
Hard Steel Over 425 Brinell	0° 5°	0° 4°	0° 5° Neg	4° 6°	4° 6°
Cast Iron	4° 10°	2° 6°	0° 5°	4° 10°	4° 10°
Brass and Bronze	4° 10°	2° 6°	0° 5°	4° 8°	4° 8°

MATERIAL	SIDE RAKE: Depth of Cut Less than ¼"	SIDE RAKE: Depth of Cut ¼" or Over	Back Rake	Front Relief	Side Relief
Aluminum	8° 15°	6° 12°	0° 10°	6° 10°	6° 10°
Die Castings	8° 15°	6° 12°	0° 10°	6° 10°	6° 10°
Hard Rubber	6° 20°	4° 15°	0° 15°	6° 10°	6° 10°
Soft Rubber	8° 25°	6° 20°	10° 20°	8° 15°	8° 15°
Copper	10° 20°	8° 15°	0° 10°	6° 10°	6° 10°
Fiber	8° 12°	6° 10°	0° 10°	6° 10°	6° 10°
Plastics	8° 12°	6° 10°	0° 10°	6° 10°	6° 10°

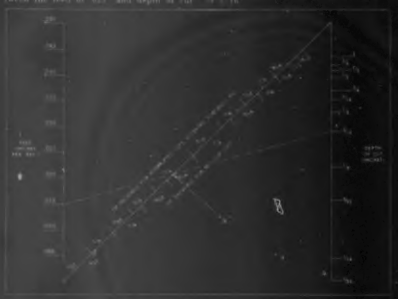
SHANK SIZE

In order to design a tool, it is essential that the depth of cut, the feed and the tool overhang is known. Given these three values, the recommended shank size can



TIP THICKNESS

By means of this nomograph it is possible to quickly determine a safe tip thickness to use. The loading of the tip depends upon the depth of cut and the feed. The dashed line will illustrate the method, and represent a straight edge between the feed of .015" and depth of cut of .125". This causes the sloping line at "X" as shown, and if you are going to take an interrupted cut we would recommend a tip thickness of ⅜". If you are going to take a regular cut, or continuous cut, we would recommend a tip thickness of .250".



"MORE PRODUCTION, BETTER FINISH, REJECTS ELIMINATED—Grinding Airplane Cylinder Valve Seats"

writes POR-OS-WAY'S WAR PLANT REPORTER

Dear Charlie:
I'm writing this from the [redacted] plant, and here's more bad news for the Axis.
The use of Por-os-way is producing one additional airplane barrel with valve seats precision-ground, every working hour. Multiply that one out, and you can see that Por-os-way's got something — something that the Axis doesn't like.
So long 'til next report
Your roving reporter
Vic

THE JOB:
Removing .010" to .012" from valve seats of airplane cylinder barrels on a Waddell Valve Seat Grinder—wet grinding at 5,000 R.P.M.

THE WHEEL
Por-os-way 3¼" x ⅜" x 1⅛" C80 HV3.

All facts and figures given are taken from an actual field survey made by a Por-os-way correspondent.

WRITE for complete booklet "Facts About Por-os-way". The address is 404 Wheatland St., Phoenixville, Penna.

THE RECORD	POR-OS-WAY	FORMER WHEEL
Pcs. per Hour (2 Seats per Cylinder Barrel)	5*	4
Dressings	None	3 per wheel
Pcs. Per Wheel	300-375	120-150
Life of Wheel	1½ days	1 day
Average Depth of Cut	.005"—.008"	.001"—.003"
Rejects	None	2%
Finish	Superior	———

*Conservative. Por-os-way has proved ability to grind 8 pcs. per hour, or 100% more than former wheel.

Remarks (by foreman). "My men take pride in their work. If a wheel is too hard and burns work, it means lost time and material and gets them sore. We are sold on the merits of Por-os-way".

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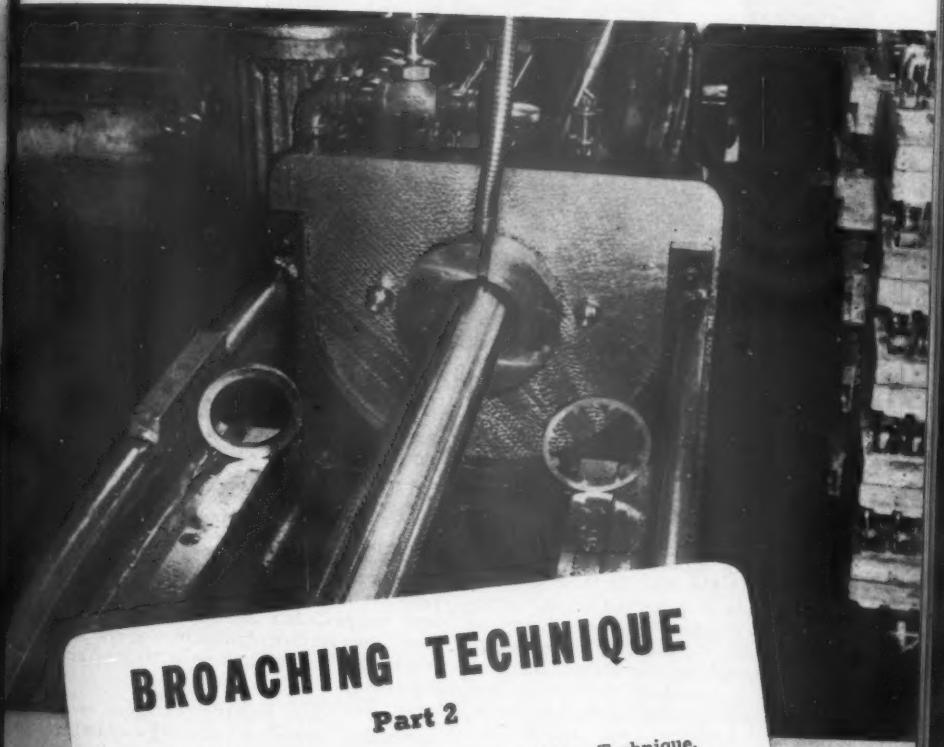
TRAINING *for Victory*

EDITORS: DON E. ROOT CHARLES H. HAYNES



BROACHING TECHNIQUE

Part 2

IN the first part of this article on Broaching Technique, the following headings were discussed: Broach Design, Type of Broaches, Internal Broaching, External Broaching, Combination and Multiple Broaching, Spline Broaching, Broaching Techniques and Broach Sharpening. Part 2 deals with Broaching Machines—types, selection, operation and care.

As broaching covers practically all types of machining —from internal and external shaping to simple key slotting and splining—broaching machines vary considerably in design and operation. Broadly they might be divided into horizontal and vertical machines and from this broken

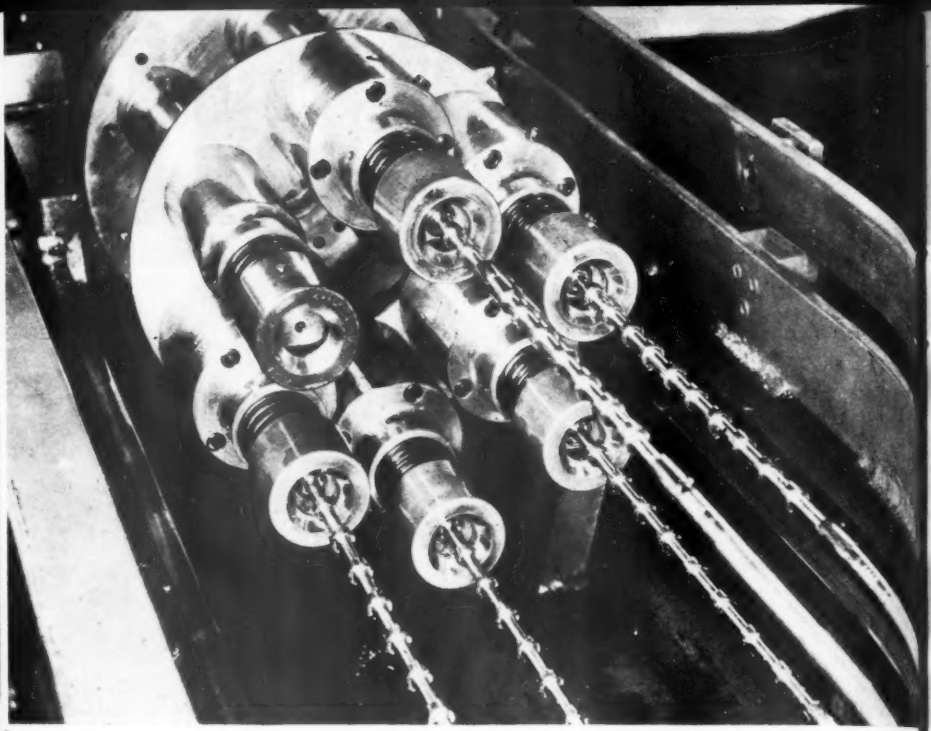


Fig. 1

down according to operational methods such as pull, push, automatic, index, turret and special operation machines.

Several standard tool machines, such as simple presses, millers and planers for stationary broaching, are adaptable for broaching but most of these are satisfactory only in a limited sense. Practically every type of broaching can be handled more economically on standard types of broaching machines. In many cases, these standard broaching machines handle several types of operations. For instance, some multiple verticals are adaptable for both internal and external work and some horizontals are jigged to make several passes and do special operations.

As broaching is a mass production, precision method, each type of machine is best suited for a special type of work. Because of the evenness of the power distribution and the absence of torque, practically all machines now are of the pull variety with the exception of certain internal and "dead head" broaching machines.

Horizontal Machines

The horizontal types are primarily used for broaching round holes, keyways and splines, but are also extensively used for surface broaching operations when provided with proper tooling and fixtures.

Most internal broaching is done on a horizontal machine, although foreign manufacturers seem to prefer the vertical for this type of work, probably because of savings in floor space. One reason for using the horizontal machine on large work is ease of operation, since the length of the broach may run to 7 or 8 feet long. On external operations where the piece to be machined is large or where multiple broaches are to be used, the horizontal machine is best suited.

Vertical Machines

The vertical machine has been universally adopted for a variety of smaller work and small stroke work both external and internal. The advantages lie in less floor space required, more adaptability of indexing features and ease of jig or fixture setup. Multiple operation external work is usually done on the vertical machine or on turret type horizontal. Vertical broaching machines are classified in several types among which are pull-up, pull-down, vertical press and the ram type surface broaching machines. The pull-up type is used primarily for internal broaching such as rounds, splines, squares, gear teeth, etc. This machine is equipped with an automatic broach-handling mechanism which makes it unnecessary for the operator to handle broaches by hand. This is especially advantageous where extremely large and heavy broaches are required. The coolant has a free flow over the work, which is applied in a vertical position and flowing downward. This helps to lubricate the entire length of broach and flood the part. It also helps to conserve floor space over the horizontal type machine.

The pull-up machine is most frequently used where it is not important to locate the internal contour such as a spline or square in relation to any outside contour such as gear teeth. The part is merely dropped over the end of the broach shank, the operator presses a lever and the broach-handling mechanism and machine ram do the work.

The pull-down machine is similar to the pull-up, with the exception that the action is reversed. The broaches are pulled down through the work. This machine is used for the same class of work, but it has one added feature, namely that it can be conveniently used where it is necessary to locate an internal contour (such as splines) in relation to some outside contour (such as a gear tooth). The part in this case is loaded on top of the platen using a locating type fixture for holding the part.

It has also been found practical to provide an extra long rear pilot guide, contained in the broach-handling bushing, to permit the broach to enter the part and seat itself before being released from the guide bushing. This helps to keep the broach from drifting and holds the broached hole square with the face

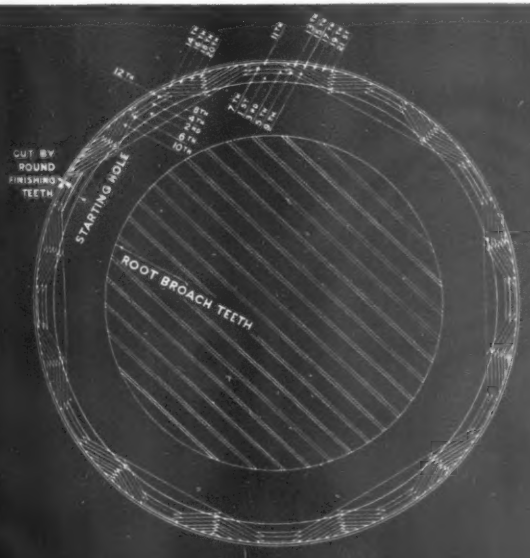


Fig. 2—Diagram showing cuts made by the "Rotor Kut" type of broach.

of the part. This is especially true in the case of spline broaching, since a spline does not drift materially after seated to a depth of approximately $\frac{1}{32}$" or so.

The vertical press can be used for hole broaching by means of push broaches. A semi-automatic device can be added which prevents the broach from falling down in the base of the machine. After the broach is pushed through the part, the part is removed and the broach is returned with the up stroke of the ram. The vertical press can also be used for surface broaching by means of a fixture having a tower for supporting and guiding a broach bar.

The ram type surface broaching machine is constructed with a slide type ram guided by means of gibs held rigidly on the column of the machine. This type of machine is used primarily in broaching outside surfaces by means of what are termed "slabbing inserts." Ram machines are made in both single and dual types.

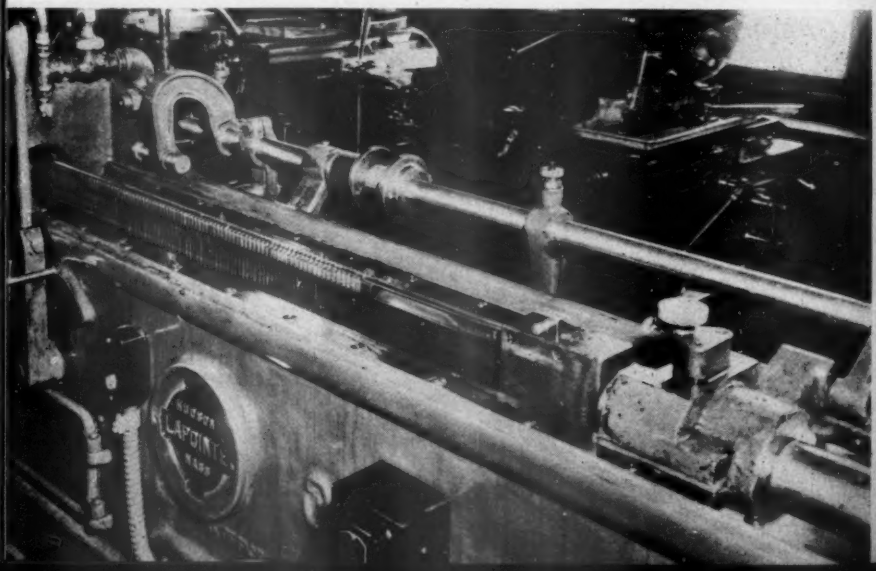
In the first three types of broaching machines, namely the pull-up, pull-down and vertical press, there is very little difference from that of horizontal broaching in connection with internal spline broaches since it is necessary to have sufficient teeth engaged in the part to prevent the part from dropping down between the broach teeth. This is extremely difficult when parts are exceptionally thin and of such design that only one part can be broached at one time.

In surface broaching it is possible to have less teeth in contact since the part is usually held rigidly in a fixture. The broach inserts are also supported rigidly on the machine ram or broach bar, which prevents the part from dropping between each tooth. Since the majority of surface broaching set-ups are outside surfaces, it is possible to have shear cut teeth which tend to give a smoother broaching action particularly on exceptionally thin parts.

Special Operation Machines

An example of special operation machines is Fig. 4, showing a broach-rifling machine where broaching does every operation on the preformed barrel on an automatic indexing machine. Another example of versatile special operation machines is the broach turret model that makes 8 cuts in one cycle of the

Fig. 3—Variable horizontal machine doing external broaching, shaping barrel handles.



machine. This machine was developed for broaching breech rings, but is adaptable for a multitude of jobs.

Selection of Machine

Selection of the proper broaching machine for any operation or set of operations is best left to the suggestions of the manufacturing engineers. The leading broach and broaching machine manufacturers have highly trained engineers who make a complete study of the part, the operation, and the plant itself and they are best able to give advice on types of machines. Careful selection of coolant, hydraulic fluid, care of the machine itself because of the precision work demanded and the broach itself are prime requisites of operation in any broaching machine.

Operation of Machine

To assure proper machine setup, the first point is to make sure that the broaching machine is of adequate capacity, including length of stroke. While the broaching speed is subject to considerable variation with satisfactory results, unnecessarily slow ram speeds reduce the productive rate as well as sometimes affecting the finish of the part. The capacity must always be sufficient to prevent stalling of the broach in the work or jerky operation during the cutting stroke. Shop maintenance of broaching machines should be such that they are kept up to rated capacity at all times.

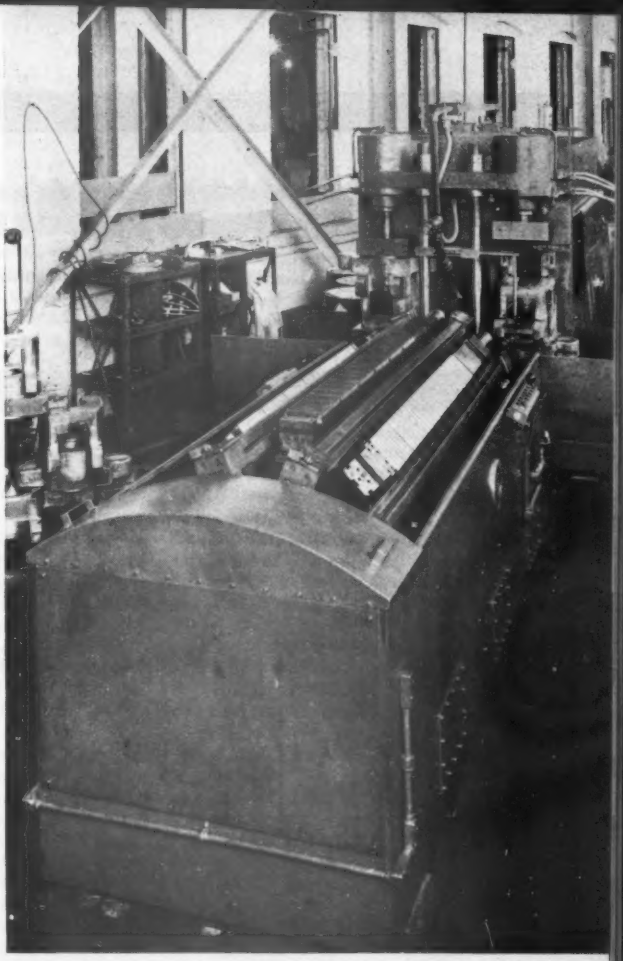


Fig. 4—Automatic lap in the HP100 with double shuttling fixture and turret.

The governing factor which determines the speed of a machine is usually the material. Many types of steel can be broached very successfully at 30 fpm. Its hardness is essentially the primary factor; although the finish required must also be taken into consideration. Cast iron, brass, aluminum and similar materials can be broached at normal speeds such as 30 fpm. This, incidentally, is regarded as the maximum speed at which all hydraulic machines operate, since it appears to be the most practical from a standpoint of hydraulic equipment and motors.

Hydraulic machines up to, say, 15 to

Fig. 5—"Rotor Kut" broach for malleable iron, seamless steel tubing, and steel forgings.

20 tons capacity, can be operated conveniently and economically by normal equipment at 30 fpm. But since the speed of the machine depends on the volume of oil that can be pumped, the greater the speed, the greater the volume, and larger motor, pumps, valves, etc., are required.

Material is not always the governing factor. For instance, in broaching cast iron, normally broached at a speed of 30 fpm, the force required necessitates a machine capacity of 40 or 50 tons. You can easily understand by the above analysis that it would not be practical to build a machine of this capacity to operate at this speed, but rather at approximately 15 fpm.

Since the finish can sometimes be improved by a slower machine speed, this fact should be kept in mind when broaching extremely hard materials such as those encountered in the present defense program. This may also prevent broaches from scoring, nicking or producing rough finish. Coolant is also a governing factor, not so much in speed, but finish.

To determine the correct speed, then, it is necessary to consider the combination of the above elements, but we believe the most effective method is experience. An efficient operator, foreman, or setup man can usually sense the maximum speed at which a machine can be operated for producing the results required.

Alignment of machine is important. The centerline of the ram head and puller must be in alignment with that of the work. Similarly, the followrest, if used, should be in alignment with the centerline of the broach. Wear in the ways of the machine, in the puller mounting, in the followrest bars or in the broach mounting hole in the followrest should not be excessive if accuracy is to be maintained and possibility of broach breakage avoided. This applies to pull-up pull-down, and horizontal type broaching machines performing any kind of hole broaching, such as round, spline or keyway cutting operations.

When holes, splines or keyways are to be broached, the centerline of the fixture in the face-plate or platen of the machine must be as accurately located as possible. Equally important is that the work should fit the fixture as closely as possible and still permit ready insertion and removal of the part. Where a question of extreme concentricity is involved, it is usually far better from a production standpoint to broach first and then machine the OD in relation to the hole.

Several additional points are important in surface broaching. The fixture must be of rigid construction to prevent any movement of the part during the pass. Also, the method of holding the part in the fixture and the pressure applied in holding it in place must be sufficient to prevent slippage during broaching as well as to hold the part in correct relationship to the broach cutting surfaces, when inserted. This is highly important both to assure accuracy and prevent catching of the part against the broach during the pass. Just as many difficulties have been traceable to insufficient fixture rigidity in broaching as in

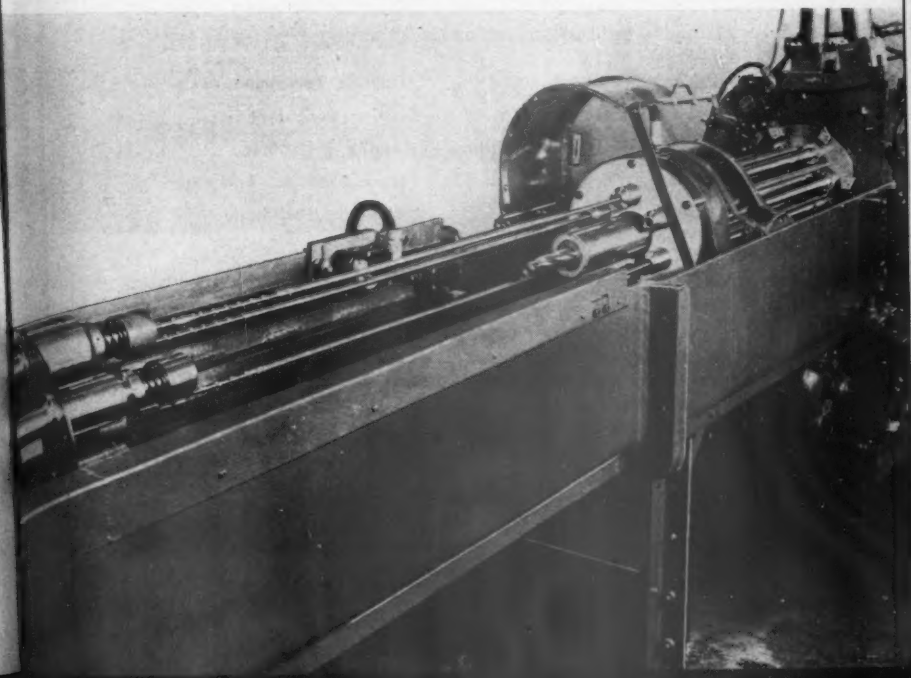
other forms of machining operations.

The previous precautions about rigid construction of the fixture and holding the part rigidly apply especially to fixtures which also handle the indexing of parts between successive broach passes. The design of the fixture must be such that there is no backlash to permit rotation of the part during the pass of the broach. This applies particularly to continuous high production surface broaching operations when extreme accuracy is required as in producing aircraft and similar precision parts.

Whenever a cored or forged hole is to be broached from the rough, an equalizing fixture should be used. The use of a fixture of this type prevents highly localized tooth loads and any tendency to force the broach out of alignment. For the same reason, a drilled hole should be square with the face or surface of the part against which it is located in the broaching fixture.

The broach should never be returned to initial position until the work has been removed. Unless the piece is removed, the end of the broach may strike the edge of the hole, not only causing possible broach breakage, but also often damaging the fixture. Before starting the broach pass, make sure that the piece is firmly seated in the fixture. In round or spline broaching this means that the piece is as fully seated in the retaining adapter as possible, and that it is seated "all the way round" and is not "cocked." Similarly, in surface broaching the piece must be properly seated and the retaining clamps brought up to full contact pressure, either by hydraulic or mechanical action, depending upon the type of fixture used. Should the part "jump" into full contact with the fixture, while the broach is moving, tooth breakage is almost certain to occur, since the part would have a tendency to cock and jamb against the broach. In the case of a hole broach, the broach itself may be broken off in addition to tooth breakage.

Fig. 6—Automatic gun rifling machine available for 30 calibre, 50 calibre, 20 mm and 37 mm.



Advantages of Broaching

If we consider "a broach as a cutting tool with a series of graduated teeth that, when pulled or pushed over a surface or through a hole, finishes the hole or surface to accurate dimensions and to any size or contour desired" to be the definition of a broach then the advantage of this type of machine revolves around three factors:

1. Elimination of other methods of machining or the replacement of several operations by a single operation.
2. Speed of the operation.
3. Precision attained.

Many operations are done by broaching in one single pull of the broach, which require several operations by other machining methods. Example of this is the work that the "Rotor Kut" type of broach does on cast or malleable iron tubing where the broach makes many internal shapes in one single operation.

Precision machining by broaching approaches the ultimate, tolerances of 1/10 are not unusual and the advantages of making interchangeable parts is exemplified by a propeller hub manufacturer who turned out the ten-thousandth part within .00001 of an inch of the first part broached.

We are indebted to the following firms who provided illustrations and textual data: American Broach & Machine Co., The La Pointe Machine Tool Company and Colonial Broach Co., among others.

REPRINTS AVAILABLE

The nine articles thus far published are:

Broaching Technique
Part 1—Broaches
Part 2—Broaching Machines
***Grinding Technique**
***Milling Technique**
***Turning Technique**
Drilling Technique
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MODERN DESIGNS FOR DRILLING JIGS AND TAPPING FIXTURES

C. W. Hinman
Designing Engineer

PRINCIPLES OF EQUALIZATION AND CENTRALIZATION

THE function of mechanical equalizers and centralizers is to hold or locate the work in tools. Either one may be used alone in a single tool, but both can also be used separately in the same tool, or together in combination. The nature of their functions is somewhat similar, that is, they are both used to clamp work, but they are quite dissimilar otherwise. This confusion of meaning has caused a misunderstanding of instructions about using them.

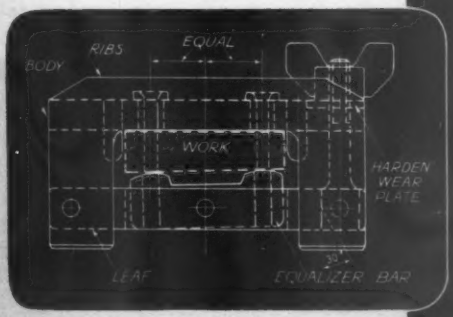
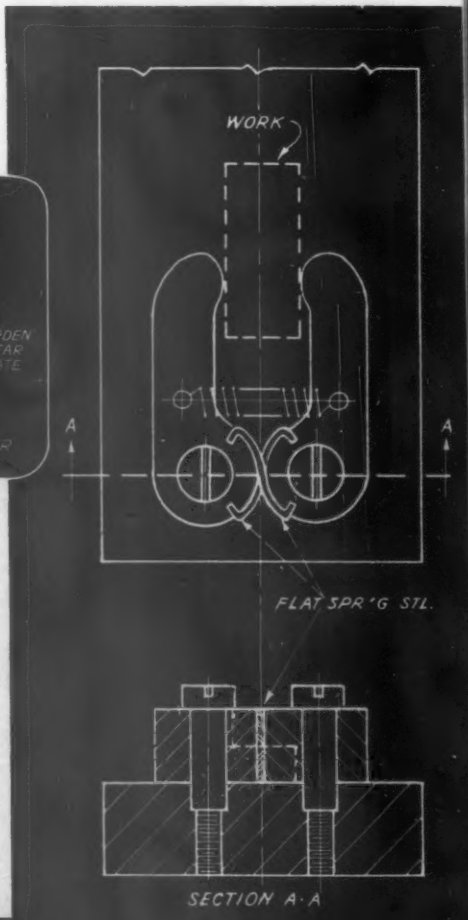


Fig. 109—A drill jig with an equalizer bar mounted in the leaf.

An *equalizing* clamp is a pivoted bar that clamps the work. It compensates for thickness variations in the work by a rocker movement of the bar. It clamps and holds the work at two or more points regardless of irregular surfaces. Its function is to hold the work for cutting operations. See Fig. 109.

A *centralizing* clamp is a pair of jaws that straddle the work. In closing together it positions the work centrally by advancing each jaw equally. The work is clamped equidistantly from its center line, or from a predetermined neutral point between the jaws. Its function is to locate the work in a symmetrical position before cutting operations begin. See Fig. 110.

Fig. 110—A pair of high precision automatic centralizing jaws.



A Typical Equalizer Bar

Figure 109 illustrates one of the uses of an equalizer bar for holding and supporting work having nonparallel sides. When the leaf in this jig is closed on the work and the wing-nut is tightened, the equalizer immediately adjusts itself to all the variations in the surface to be clamped, and forces the work tight against the floor of the jig, ready for drilling.

Automatic Centralization

Figure 110 shows a pair of automatic centralizer jaws that are an unusual application and comparatively new. The thicknesses of the flat springs are exaggerated in the sketch to show their operation clearly. The springs are bent to the shapes of compound arcs, and the hooked ends are "sweated" in the slots. This centralizer will take any width of work placed between its jaws, if the size is within the maximum range of the jaw opening. To make this centralizer accurately and as sensitive as it should be is a watchmakers' job, but once made it will function perfectly. When using this equipment in a drill jig, a positive clamp is employed to hold the work after the jaws have centralized the piece. This device is used in high precision tool work, such as drilling and reaming small parts for guns or delicate parts of instruments.

Centralizers Operated by an Equalizer

A drill jig in which both equalizing and centralizing are involved is seen in Fig. 111. The centralizing principle shown here is a comparatively new application of it. The work has nonparallel sides and ends, but the centralizers take care of that. The work in this jig is centralized both ways, that is, in its width and length, and regardless of reasonable variations. This tool is shown with all its fastenings closed.

To load the jig, the fastenings are opened and the work is placed between the two end cams and the four centralizing pins. The handle at the right is then moved toward its locking position and the cams force the work to be clamped and centralized endwise. Next, the screw that operates the equalizer is tightened. This forces the two centralizer bars and

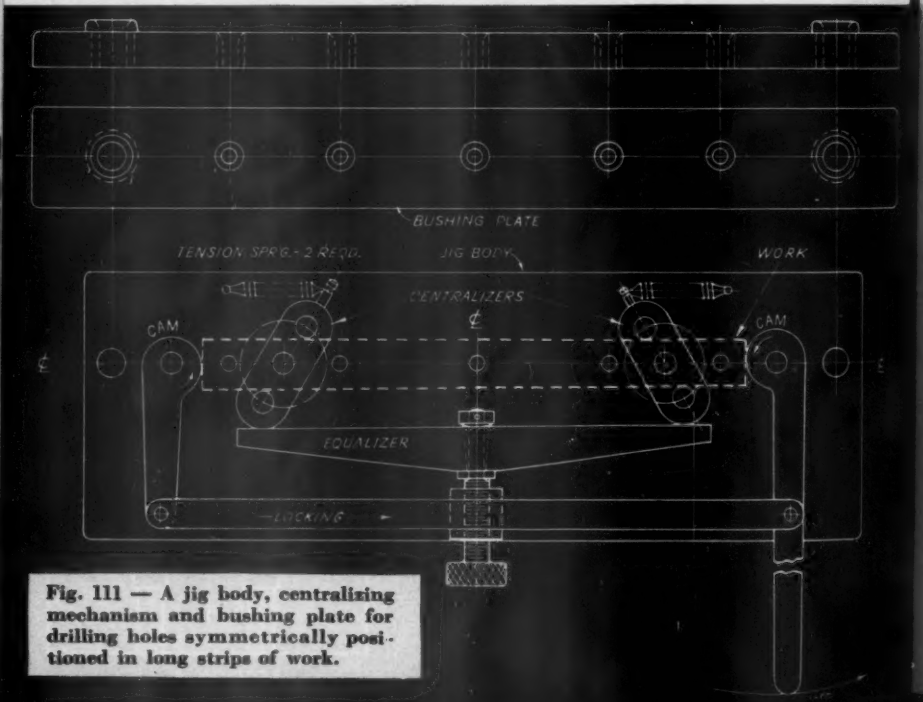


Fig. 111 — A jig body, centralizing mechanism and bushing plate for drilling holes symmetrically positioned in long strips of work.

pins to clamp the work sidewise and to centralize it symmetrically about the center lines of the jig body. The vertical and horizontal center lines in both the work and jig now coincide, and the whole group of five drilled holes will be positioned symmetrically in the piece. The bushing plate is then placed over the work and is located at the ends by pins that enter corresponding bushings in the plate.

However, it is usually not good practice to locate the work independently from the drill bushing plate. It is shown that way here in order to present the idea clearly. It is not impossible to attach the centralizing mechanism on the bushing plate, and in that case the gaging and drilling would both be done from the same individual part of the tool.

An Equalizing and Centralizing Jig

The cast iron part sketched in Fig. 112 is drilled in the jig shown in Fig. 113, and the annual production requirements are very large. Thickness dimensions *B* and *C* vary considerably in the different pieces and therefore two compensating equalizing bar supports *D* are provided on the leaf of the jig. Before drilling this piece, however, a milling cut is taken across the faces of the five bosses and a light cut is made simultaneously at points *E*, which causes dimension *F*, or the length of the arms, to be approximately equal.

It is not an easy problem to design a single operation jig for this piece—a jig which is rapid in operation, convenient to load and unload, to support and drill a hole through the frail lug *G*, to equalize and support the work against the thrust of six drills in a multiple spindle press, and to properly centralize the work sidewise. Therefore, the method of procedure and a practical tool design for handling this piece is discussed.

The jig body is of cast iron, or machined from a block of machinery steel. The leaf is also of machinery steel finished all over. The two ribs along the top of the body strengthen its channel and leaves the floor of the jig open for cleaning. The height of the ribs must

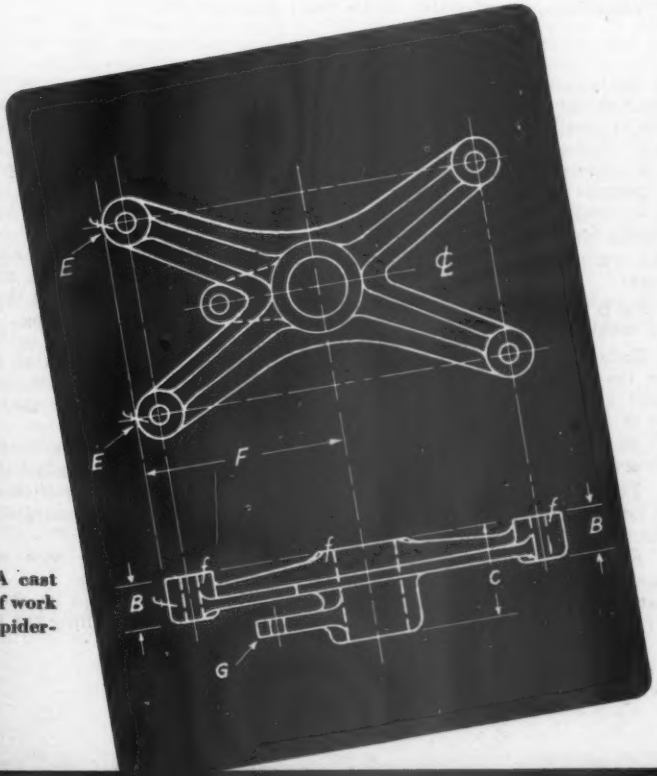


Fig. 112—A cast iron piece of work called a "spider-frame."

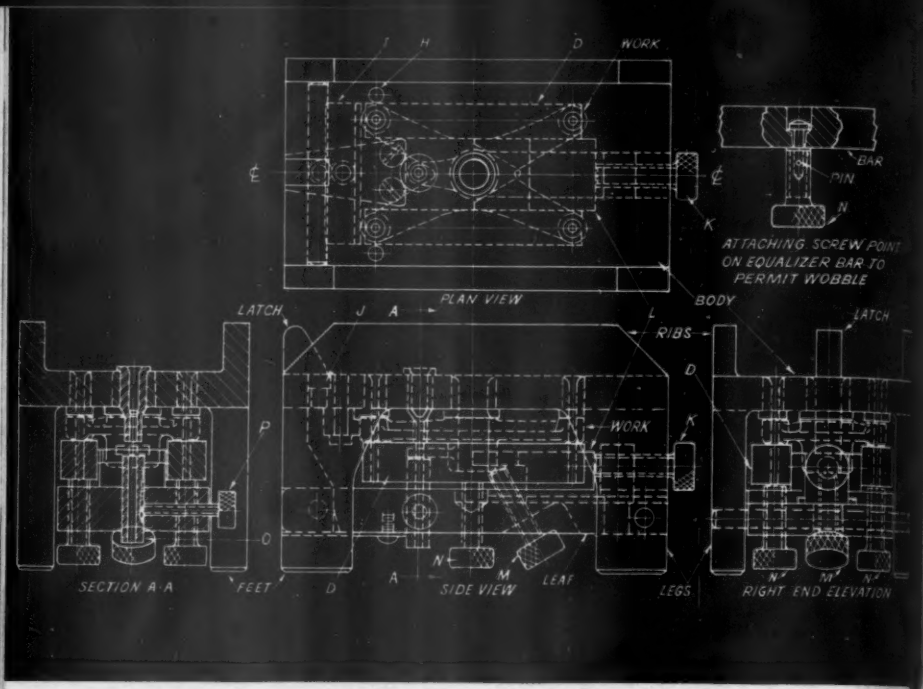


Fig. 113—Channel and leaf jig in which the work is held for drilling by equalizers, a centralizer, and a touch pin support.

clear the top end of the latch. Notice the compact design of this tool. Its size is no larger or smaller than is absolutely necessary. For example: screw *M* in the leaf is surrounded by a clearance cavity that permits making this screw shorter than normally and, therefore, the height of the jig body can be made less.

The work is loaded into this jig as follows:

1. Jig is placed, ribs down, on the drill press table, with the leaf opened.

2. Ends *E* of the work are placed between the two approximate locating pins *H*, and against equalizer bar *I*. The faces of the finished bosses being placed down on the surfaces of five shouldered bushings.

3. The leaf is then closed, and the latch hook catches and holds tightly over the hardened wear pin *J*.

4. Screw *K* is then tightened, which advances V-block *L* and at the same time thrusts the work back against equalizer bar *I*. The work is thus forced to become locked with its center boss in the V-jaws, and by this movement it has become centralized sidewise. The longitudinal and cross center lines of the work piece and of the jig now coincide perfectly.

5. Supporting screw *M* is then advanced against one corner of the large boss, and two screws *N* are tightened against equalizer bars *D*, all of which supports the work against the five shouldered bushings for drilling. It is immaterial whether screws *M* or *N* are tightened first, because the work has already been properly located in the jig by screw *K* which advances the centralizing V-block.

6. The operator, using his fingers, then pushes touch pin *O* against the frail end of the lug *G*, and locks it there by tightening screw *P*, as illustrated in section A-A.

The loaded jig is now ready to be turned over on its feet and placed against positive stops on the drill press table, ready for drilling the holes.

INSPECTION TECHNIQUE FOR THE SMALL PLANT

K. F. Kirchhofer

GEORGE SCHERR COMPANY

AMERICA has always been the land of opportunity. By dint of hard work, self-denial, study, regular saving and a bit of luck, any man in almost any line of business has had a chance to start and build up a business.

Take Bill Smith. Starting as an apprentice in the big machine tool plant in his town, he slowly learned his trade —lathe hand, milling machine operator, set-up man . . . tool and die maker. Nights were spent in studying mathematics, machine shop practice, production methods. Skill and wages increased. Finally he left the big plant, purchased a second-hand lathe, bench miller and grinder. The garage became his first shop. The little business grew. A couple of the boys from the big plant went to work for him, the "garage" shop moved to larger quarters; and one day Bill Smith had a nice little plant with thirty men on the payroll.

There are thousands of Bill Smiths throughout the United States. Today, everywhere, such "little business" is fighting for survival. The enterprise, personal initiative, unswerving devotion to an idea which are behind the small shops, plants and factories must not be sacrificed; for small business is the backbone of the nation.

We are here concerned primarily with the small metal-working plant, employing five, fifty, or a hundred people. In normal times such plants make specialties of various kinds—metal ash trays, jewelry, novelties, hardware items, gadgets, lamp-bases, toys, parts for simple machines and household wares.

These articles are easy to make, with wide tolerances and little accuracy required. Once a production system has been established it is a matter of feeding metal to the machines and shipping the finished gadget.

The war has changed all this. Fuzes, shells, bombsight parts and gun components replace vanity cases, pots and pans, watches, plastics novelties. Most of these smaller plants have never been forced to maintain the rigid tolerances that are absolutely essential in producing munitions, guns, planes and tanks. Formerly these shops had a few or many thousandths of an inch to play with. Today, more often than not, blueprints call for dimensions of "tenths of thousandths" which must be kept. In many cases, the smaller metal-working plants already have the lathes, milling machines, surface grinders, drill presses, shapers and other machine tools that are necessary.

But in most instances—they do not have adequate inspection equipment that will guarantee the accuracy of their work, or to enable them to detect errors at the source. This is one of the leading reasons why the potential power of these miniature arsenals has not yet been entirely harnessed to the war effort.

In New York and in other sections of the country, various plans are being made to bring the small shops into the war picture. One is the pool plan whereby a group of plants, or perhaps an engineering firm, will accept a prime

(Continued on Page 120)

(Continued from Page 119)

contract for Army and Navy work. This contract will be broken into approximately sixty sub-contracts, and farmed out to sixty small shops. The small shops may accept the work and deliver in the belief that the part conforms with the tolerances demanded. Then, when the parts are received by the prime contractor or wherever ultimate assembly takes place and are subjected to rigid inspection, much of the work may be rejected due to errors that the smaller plant, without the necessary inspection equipment, cannot detect.

Thus, if among 60 sub-contractors there are only five whose output is rejected, it is entirely possible that the entire production program will fail, and that final assembly of guns and implements of war so sorely needed at the fronts may be delayed. Not only are the efforts of those five plants valueless, but the work of the other plants is temporarily useless. Without adequate inspection, waste and spoilage of material, disputes within the small plant regarding measurements, disagreements between sub and prime contractors and delayed deliveries will all result in lost time.

Prime contractors with such experiences may hestitate to distribute subcontracts among small plants unless these shops can actually prove that they have the inspection equipment necessary to check their work.

A way must be found to provide the smaller war plants with a small, compact, simple, dependable, yet adequate inspection department absolutely indispensable in interchangeable manufacture. In this modern war-fare, which precision experts have stated is being waged in "tenths of thousandths of an inch against the thousandths of an inch of the last war", the implements of war must be interchangeable. That is why inspection—measuring and checking with dependable instruments, gages and tools—is so vitally important.

Some small idea of the importance of inspection equipment can be obtained from the following. Fire swept through a section of a small sub-contracting plant one week-end. The machinery was not damaged, but the toolroom and its contents were virtually destroyed. Included in the loss were the only set of gage blocks in the plant, micrometers, dial indicators and other inspection tools. As a result, production was practically at a standstill. Urgent telephoning and cooperation on the part of his suppliers enabled the sub-contractor to reinstate his inspection department in about ten days. Again he was able to resume his place as a valued and dependable subcontractor who knew, because he had the necessary inspection tools, that parts within the tolerances required would not be rejected.

Part 2 of Broaching Technique, in this issue, discusses in detail the different types of broaching machines. Valuable design and construction features are included. Part 2 is a continuation of Part 1, which appeared in the July Training For Victory Section. Included in Part 1 were the types of broaches, maintenance problems and typical examples of broach designs. Reprints of Part 1 and Part 2 are now available.

We are accustomed, when talking of war production, to thinking in terms of millions of dollars. Yet it is a fact that the installation of a simple, yet adequate inspection department for a small shop can be accomplished for well under a thousand dollars. There are today organizations in the precision measuring line who understand the problems of the small shop and have already placed so-called limited budget inspection laboratories on the market.

This inspection equipped may be used to check, inspect, measure and test; may save thousands of man-hours; may eliminate countless rejections; and may actually save tons of critical materials.

ELECTRONICS IN INDUSTRY

Carl J. Madsen
ELECTRONICS ENGINEER
Westinghouse Electric
and Manufacturing Company

THERE are probably as many definitions of the word "electronics" as there are individuals associated with its application. One definition is: electronics is the application of devices in which the flow of free electrons are made to perform such functions as to rectify, amplify, generate, control, convert light into current and current into light. The necessary tubes may take the form of diodes, triodes, ignitrons, pentodes, beam power tubes, thyratrons, phanatrons, kenatrons, photo tubes, cathode ray tubes and so on. A brief study of the application of these hundreds of types of tubes shows that the science of electronics is not new. It also shows that the future possibilities are extremely important in that hardly a week passes without the development of new tube types or new combinations of tubes and circuits to perform new functions.

The developments of electronics can best be explained by these nine classifications:

Rectification
Inversion
High Frequency Heating
Communications
Measurements
Control
Inspection and Sorting
Precipitation
Radiation

There are two fields which have been important in past years in rectification. The first is power rectification. The second, high voltage rectification, is important in that it is frequently employed as a means to an end in many other types of electronic equipment, such as power supply for high frequency oscillators, Radar, communication equipment, measuring equipment, and our broadcast receivers and transmitters. Rectification will have an important position in most of the electronic devices which may be developed in the future because of the nature of electronic tubes.

At the present time relatively little work has been done in the use of inversion principles. A few particular applications in the conversion of 25 to 60 cycles and vice versa have been made. However, the use of inversion will become increasingly important to a number of industries in the future as a source of variable-frequency, a-c power which provides a means of variable speed control for drives employing a-c motors. It should be extremely useful in the operation of certain high-speed machine tools for variable-speed control.

High frequency heating was the subject of much experimental work more than ten years ago. Experiments were conducted at that time in the heating of various materials such as plastics, bonds, food, metals and cements. A number of these applications have been brought to the forefront recently.

Some of the present applications employing dielectric heating are the bonding of plywood and the heating and curing of plastic materials. Dielectric heating has its important application where thick sections of plywood, thermoplastic or thermo-setting materials are involved. The development of thermo-setting bonding materials now permit fabrication of thick sections of plywood in the matter of three to five minutes. Hours were required with steam or other form of heat. The same is true in the heating and curing of plastics. In addition to speed, the electronic method does a more thorough and uniform job.

Another important phase of high frequency induction heating is used in the heating of metals. With this method, faster and more uniform heat treating, annealing, brazing, welding, soldering and tempering has been made possible. In some processes, time has been reduced from 2 minutes to 5 seconds. It is pos-

(Continued on Page 212)

PROGRESS ON

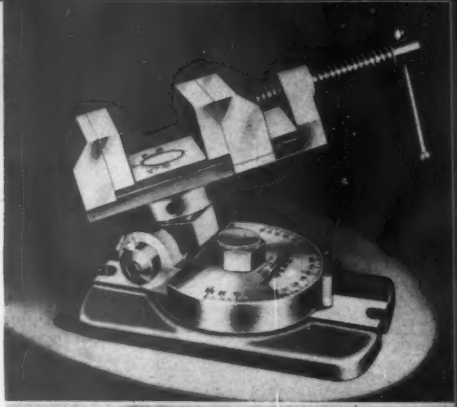
SINCE the introduction of the State multiple cutter adjustable boring and reaming bars eighteen months ago, many new applications for their use have been found in hundreds of production plants. The picture, left, below, showing a group of both standard and special State bars, illustrates the diversified adaptations that are possible. Bars with pilots, wear strips and collars are shown as well as a duplex bar containing two sets of multiple cutters for boring diameters. Complete details on engineering the bars to handle other boring and reaming operations will be furnished upon application to State Mfg. & Construction Co., Dept. T., Franklin, O. 138-B

A GIANT among honing tools, said to be the largest ever made in the world, is shown at bottom left on the next page. Forty-one and one-half inches in diameter, it is here being machined on a Defiance boring mill at the Micromatic Hone Co., Detroit. According to D. W. Champlin, vice president and general manager of the Defiance Machine Works, Inc., Defiance, O., handling jobs like this is all in a day's work for this company's heavy-duty horizontal boring, milling, drilling and tapping machines. The well-balanced, rugged design of these machines contributes to their high degree of accuracy in day-in day-out performance, he declared. 140-B

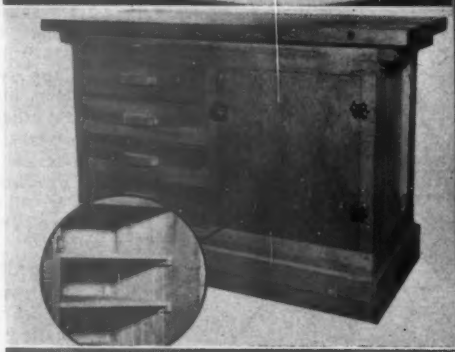
A NEW streamlined acid-proof inspector's kit (right, below) has been developed by Jas. H. Matthews & Co. for users of their "S-22" Synthetic Stamps. The kit holds four stamps (and can accommodate more). Acid etching ink is kept in one bottle, oil or neutralizer in the other. A stamp pad is kept in the drawer shown at the front of the unit. The drawer is quickly and easily pulled out, for re-inking pad by means of a glass tube provided. The self-closing cover on top of the kit prevents the acid fumes from escaping, a very desirable feature since the fumes may affect precision parts. For full details, write to Jas. H. Matthews & Co., 3896 Forbes St., Pittsburgh, Pa. 139-B

WHILE only one-fourth as large as the conventional type gage block case, the new case designed by Savage holds the 81 DoAll Precision Gage Blocks in full view of the user. In addition to its convenient size, the box displays the blocks for easier removal and selection. Each block is placed at a slight angle in the case so that the etched size marking near the top of each block can be readily seen. The convenience of handling the new box lessens the hazard of dropping the precision gages and damaging the finely lapped surfaces. The case is illustrated (bottom, right) on the next page. For further information, address the Savage Tool Co., Dept. D, Savage, Minn. 141-B

PARADE

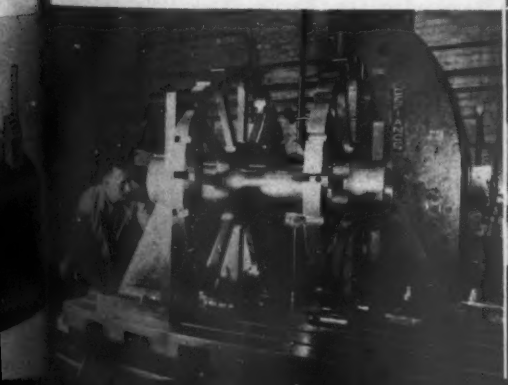


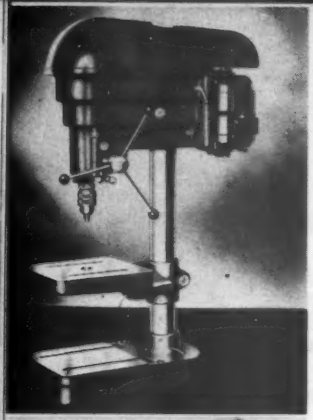
JUST announced by the Berco Mfg. Co., 433 W. Superior St., Chicago, Ill., the new Hilco All-Angle "Driv-Wheel Movement" vise has three highly accurate and legible protractor dials for horizontal, vertical and diagonal settings. Shown top, right, it is available in three sizes: 3½", 4½" and 6" jaw widths. The manufacturer recommends it for grinders, drill presses, milling machines, magnetic chucks, many other machine tools and for bench use. 142-B



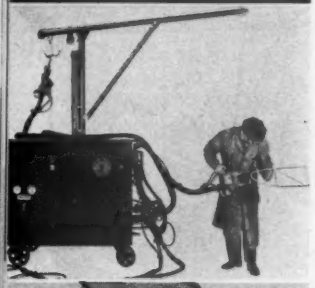
AN improved heavy-duty work bench designed by the Aeronautical Trading Co., 169-23 Rockaway Blvd., Jamaica, L. I., is being used by war plants throughout the nation. Thirty-four inches high, the bench top measures 22" x 48" and weighs 160 lbs. The top is "carriage bolted" to the sides. The bench, which can be used for lathes, drill presses, and grinders, can be equipped with wood working vise at small additional cost. 143-B

TO meet the extremely heavy load requirements of one of the leading aircraft motor manufacturers, the extraordinary surface plate, shown right, was manufactured by Machine Products Corp., Detroit, Mich. The plate is of Meehanite iron, measures 4' x 6' and has a depth of 20". Its total weight exceeds 2 tons. Mounted on specially designed pedestal type base, it is provided with three adjustable bearings. It will remain uniformly level. 144-B



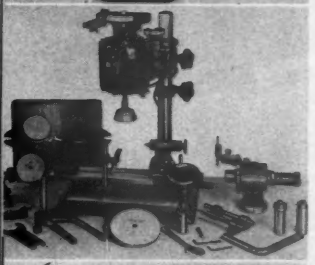


PERFECTLY balanced and motionless, this Helmet Head Drill Press is sealed against common hazards. Over 60 models are now being offered by Boice-Crane Co., 963 Central Ave., Toledo, O. These are available in one, two, three or four spindle types; high and slow speed; bench or floor type; slotted or trough table. Five carefully pre-determined efficient speeds allow for every operation. A feature is the new self-centering 30° pressure angle 6-tooth involute spline. The spindle, quill and spindle-pulley are held in permanent alignment. 145-B

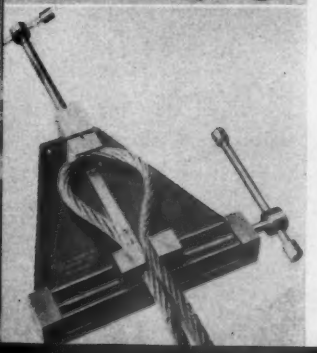


EQUIPPED with an electronic timer and a wide selection of both air operated and manual "tong" type guns, this self-contained field repair cart was developed for repair spot-welding of airplane steel parts. The cart is capable of doing just about any kind of a spot welding job on stainless and other light gauge steels. Refrigeration of transformers, cables and guns eliminates the need for external water connections, the condensor in the "Frostrode" refrigerating unit being air cooled. For full information write to the Progressive Welder Corp., Dept. T, Detroit 12, Mich. 146-B

A MASTER Set of standard plug gages for hole inspection has been announced by Sav-Way. The set includes 147 plugs and 4 handles in a unique plastic case with a transparent cover which presents a clear view of the contents. Plugs are set in increments of 64ths, starting at ¼" and going to 1". There are three plugs of each nominal size—.0005 over, standard, and .0005 under. All plugs are deep-frozen before finish grinding. Further information will be supplied by Sav-Way Industries, 4877 E. Eight Mile Rd., Detroit, Mich. 147-B



HIGHLY versatile, this new Roan tool and cutter grinder is equipped to handle the grinding of practically all types of milling cutters. Sturdily built, with graduated adjustments throughout, it is designed for simplicity of operation, fast set-ups and high-speed precision grinding of assured accuracy. Unusually compact, this unit has a base 18" x 16" and the column is only 25" high. Complete descriptive material will be supplied by Roan Mfg. Co., 1229 Washington Ave., Racine, Wis. 148-B



A PORTABLE Rigger's forming vise that handles wire rope and cable from ⅜" to 1¼" in diameter without adapters is the newest development from Patrick-McDermott & Co., 1649 E. Slauson, Los Angeles, Calif. Splicing and clamping operations as well as the forming of cable into an eye or around a thimble are easily handled in a minimum amount of time. The cable is securely held and the new forming vise is equipped with guards to protect against cable and thread friction. 149-B

Industrial Digest

TOOLING • PRODUCTION • WAR NEWS • PUBLICATION REVIEW

"Tailor Made" Heat Treating

THE die shown in Fig. 1 is used for casting aluminum aircraft parts and is made up of four pieces; the body and a three section ring. The body is of air hardening steel: .30 carbon—1.5 moly —1.05 tungsten — 4.75 chromium and .25 manganese. This part of the die was hardened first.

Fig. 1

None of the controlled atmosphere furnaces were large enough to handle the die, so we improvised one with a retort furnace.

Careful Preheating

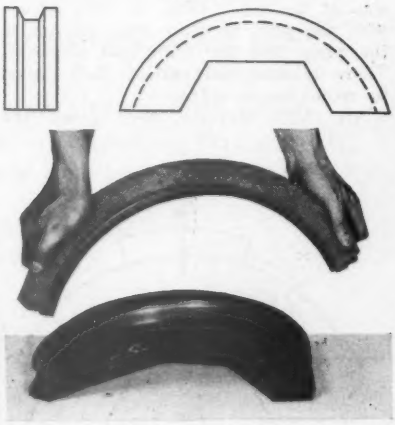
With several inches of charcoal placed in the bottom of the retort, the die was laid flat on a grid supported above the charcoal high enough to prevent contact with it. The retort was sealed and the temperature was brought up to 1200°F., and held there for three hours; raised to 1400°F., and held three more hours; raised to 1600° F., and held four hours. Then the temperature was brought up to the hardening heat at 1850°F., and the die was given a three hour soak.

It was then removed from the retort and cooled in *still air* while suspended on a bar run through the center hole and supported on two horses. When it reached 700°F., it was checked for flat and checked frequently from that degree down to room temperature.

We put the die in a forced convection tempering furnace and tempered it at 1025° F. for eight hours, at the end of which time it was removed and checked for flat again. Replaced in the same furnace the die was given another eight hour temper at 1040°F.

The final check for flat showed that the die was only out .003" with a Rockwell of 44-46 "C".

Fig. 2



The toughest problem was yet to come, and that was the sectional ring part of the die. A fixture, or template, was made to keep the sections in shape while they were air quenching. This fixture is shown in Fig. 2.

The three sections were also made of air hardening steel: .32 carbon—1.40 moly—5.5 chromium and 1.00 silicon. Each section of the ring was heated singly because the fixture could accommodate but one at a time. The parts were preheated for two hours at 800° F. in the forced convection tempering furnace and then transferred to a neutral atmosphere preheat of 1550°F., for one hour, and then they

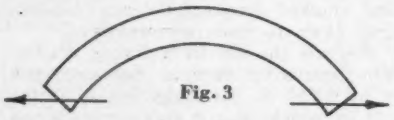


Fig. 3

were placed in a high heat atmosphere at 1850°F., for another hour.

On withdrawal from the furnace, the end of each section had pulled out sideways (Fig. 3), but upon cooling they drew together so that when the part was placed on the straightening fixture at about 700°F., the high spot was at the top. (Fig. 4) The fixture with the part in place was put under the press and the high spot squeezed. There it remained until it had cooled to room temperature.

All three sections were given the same treatment, at the conclusion of which they were placed in a tempering furnace for eight hours at 1025°F., and then retempered at 1040°F., for another eight hours.

The parts were cleaned of the light scale that had formed when air cooling, and checked again for distortion. The four pieces, when assembled, were out only .003".

(This is a digest of an article by A. Olson and A. Uitti in "Heat Treating Hints", published by the Lindberg Engineering Co.)

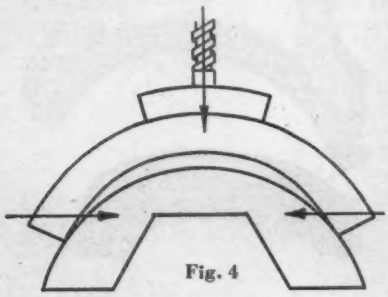


Fig. 4

Moslo Welding Show a Success

The Moslo Machinery Co. welding show, announced in the May issue of The Tool & Die Journal, and just concluded in Cleveland, was attended by representatives of rod making companies, welding engineers and representatives of foreign purchasing commissions.

The plant set up for the show is now being dismantled for shipment to an im-

Flux compressed in the chamber of the steel extrusion die-head, under approximately 250 tons pressure, coats rods as they are rapidly thrust through the die by the feeding machine in the foreground. This was a portion of the complete welding rod processing plant recently shown in actual production by the Moslo Machinery Co.

Maybe your shop is one of the shrinking number that doesn't yet know about and use Victory Tool Shanks . . . those low cost, long lasting shanks, cast to shape of tough Meehanite, to which you cement your own carbide tips.

Some of the busiest, most exacting plants in the war industries have been using Victory Tool Shanks regularly for many months. These shanks have several distinct advantages over carbon steel and besides, they are not critical—can be furnished promptly, in quantity.

This illustrated catalog, Bulletin 53 T-2, tells the whole story—sizes, shapes, characteristics, prices. Write for your copy today.

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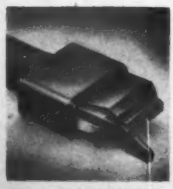
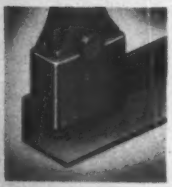
THIS MERCURY TYPE HOLDER is the efficient solution to the *accurate* numbering of parts, *vitally* important in today's war production programs . . .

It stamps the *entire* part number—up to 16 characters if needed—with just one blow of the hammer. One setting of the part number in the Holder enables you to mark as many duplicate parts as desired—quickly, accurately and neatly. It eliminates inefficiency and time lost using single-character stamps for each separate figure or letter, and all of the errors common to this method such as overlapping, wrong sequence, etc.

In addition, Mercury Type Holders offer you these outstanding features that insure faster, better stamping operations . . .





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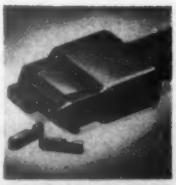
Available complete with hardened and ground hand-cut steel type in all popular sizes and in special models to meet specific problems. Descriptive folder—mailed free—gives details and specifications for both hand and press style Holders. Write Dept. 9D for your copy.



MERCURY METAL DIE & LETTER CO., INC.

546 E. 16TH ST., LOS ANGELES 15, CALIFORNIA

PLASTICS MODELS
AID PRODUCT DEVELOPMENT

By Carl Stricker - Stricker-Brunhuber Corp.

MANUFACTURERS of numerous products have achieved important savings of time and money and a better refinement of design by first developing plastics models of proposed new products.

These study models, as they are called, transform ideas into reality. An invaluable aid in the solution of experimental problems, such models give designers, engineers and laymen a clear conception of how a product yet in the blueprint stage will look and function. Thus, in developing a trial model, the manufacturer has a representation of his idea that he can study from all angles, actually test in operation, and observe its performance. The bugbears can be easily spotted and corrected before an expensive steel die or mold is prepared.

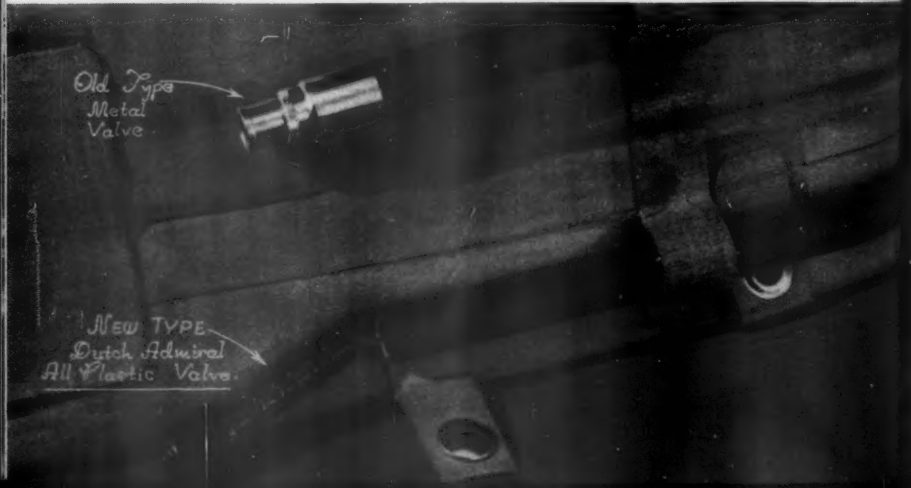
Many parts that look acceptable in theory often reveal several shortcomings when put into practice and a proper model will show where redesign is necessary in order to obtain the best molding practice.

The advantage of comparing new products against competing items already on the market is obvious. These checks on the workability of a product and on its sales appeal *before* the usual expense of tooling up for production makes the use of plastics models a compelling economy. For altering hard steel molds is always a costly job, frequently forming a considerable addition to the finished cost of the article.

The reduction of time delay is often just as important, because it is evident that changes in design can be effected more easily and rapidly when in a model stage. A model also saves time when it is used to check the part sizes of completed pieces in the process of making the mold.

A model is generally desirable to the molder who will eventually mold the part and also to the mold maker. They can work well from blueprints, of course, but it is much easier to visualize the product from a three-dimensional model. Particularly in the case of the mold maker are models helpful. With them, he is able to foresee, and thereby avoid, difficulties.

All plastic valve used on United States Navy pneumatic life belt emergency inflating tubes.



MOLDING SCREW THREADS IN PLASTICS

IT is often desirable to mold a screw thread in a plastics part. Some of the factors which determine that a thread be molded are listed below.

General factors:
- Large diameter—½" or more.
- Smooth, polished finish required on threads.
- Threads must run close to a shoulder.
- Threading or tapping equipment not available in the manufacturing setup, especially for large sizes.
- Use of metal inserts forbidden by the nature of the design.

Factors for thermosetting materials:
- The granular structure of a tapped or threaded part may be undesirable.
- The high cost of taps and dies which must be chrome plated several times during their short life.

Factors for thermoplastic materials:
- The tearing of the threads in machining causes them to be rough and poor in appearance.
- Lack of facilities for supplying coolants in threading operations.

There are three general methods for forming a molded thread in plastics parts. All have their appropriate applications. One method is to split the mold longitudinally along the axis of the thread. This is a good method for long external threads because the time required to remove the piece from the press is short. With proper facilities to align the mold halves and with careful operation, split thread molds can be made to produce nearly flash-free threads. However, mold wear usually increases the amount of flash and the thread halves of the mold may require replacing long before the rest of the mold is worn to the point where general repairs are required. For this reason, the split thread halves should be made as units or blocks which may be replaced easily.

A second method of forming molded threads in plastics is by stripping the part from the core. Special thread forms have been developed, allowing the molded part to be stripped or pushed off the thread cores while the plastics material is still soft enough to allow the slight distortion required. Unscrewing is not required. Thermosetting materials with a curing time slightly longer than normal are available for this use, and thermoplastics are readily adaptable.

The most frequently used thread molding device is a thread plug or ring which is unscrewed after the molding is set to shape. A large variety of such unscrewing devices, ranging from removable plugs to be unscrewed from the molding by hand to entirely automatic unscrewing mechanisms built into the mold itself, have been developed. For certain types of closures, which are made in large quantities in compression molds, the thread cores are mounted on a plate having a capacity of 150 or more cores. Two plates are provided so that one can be used in the mold while the press operator is unscrewing the moldings from the other plate with an air or electric motor which has a collet made to fit the particular molding.

The advantages and disadvantages of loose, individual thread cores are a matter of considerable controversy in the molding industry. The danger of loose cores falling out because of quick reversals of direction of travel of the press is small in slow-moving compression molding machines. On the other hand, injection molds usually travel much faster and provisions for holding loose cores in place must be more carefully made. The danger of placing the core

incorrectly and closing the mold on it is present most of the time for both types of molds. Some molding engineers prefer all thread cores attached to the mold and to have them operated manually or automatically without being removed from the press.

Thread molding technique includes, among other things, having the thread cores polished and of accurate helix and form for easy unscrewing. Shrinkage of the plastics materials on cooling causes the moldings to stick to the cores. For this reason smoothness and accuracy help to reduce resistance to twisting the core from the piece. For rapid unscrewing, double and triple threads are advantageous when adapted to the molded part. Proper filling of the threads is greatly aided by mold venting and by loading the mold for the most advantageous flowing conditions. The position and size of the gate of an injection mold, for example, are extremely important. A well kept record of experience is perhaps the best guide for positioning the gates of an injection mold. Compression molds may require a ring preform and powder combination load in order to fill a sharp thread with a thin outside wall.

For ordinary work where extreme accuracy is not required, it is not necessary to allow for shrinkage lengthwise unless the thread is relatively long. The fact that the core is in place until the thread has solidified is a factor in eliminating shrinkage difficulties. The thread of plastics material is prevented from moving by the restraint imposed by the threads of the core. The soft plastics material can shear and flow slightly outside the thread and thus allow the portion of plastic in the thread to stay where it is during the cooling. Consequently, the inaccuracy of lead in the molded thread is likely to be slight and of negligible importance in the average application. Diametrical shrinkage is not negligible, however, and due allowance must be made.

Molds with loose thread plugs often have been described in detail, but molds with self-contained unscrewing mechanisms are less common, and hence have seldom found their way into print. The latter type of mold, usually highly specialized, is used under the most favorable warranting conditions. There are not many conventions in the design of unscrewing molds because of their special nature. The injection mold illustrated is automatic in operation. It derives unscrewing force from the motion of the injection press platen.

A small knob, the outline of which is shown in the cavity blocks (details 16 and 18) is to be molded in large quantities. Its manufacturer has all available presses running nearly at full capacity and must, therefore, make full use of his equipment. A six cavity mold, which is automatic in operation, is estimated to produce 250 more pieces per hour than the same mold with individual removable cores.

The mold is designed with the unscrewing and ejecting mechanism in the rear half of the mold. The individual thread cores are turned by racks (detail 5) which are moved in the horizontal plane by means of inclined fingers (detail 13). Only one-half of the mold is shown in the face view at the right, since the mold is symmetrical except for the direction of the fingers which must slope oppositely in order to turn the gears in the proper directions.

The mold is shown in the closed position, ready to open. Finger and rack in the left hand view are on the far side of the mold. As the mold opens, the stationary finger causes the racks to move across the mold and turn the core assemblies (detail 17) so that their screw threads back them out of the rear cavity blocks (detail 18). This causes the thread rings to back off from the molded pieces, which are prevented from turning by the gate connections at the ends of the runners (detail 22). The motion of the racks is completed during a portion of the opening travel of the press platen. The rear half of the mold continues to move back after the fingers have disengaged the racks, which are stopped by detents so the holes in the racks (detail 21) will be in line with the fingers when the mold closes. Near the end of the opening travel, the ejector rod comes through the hole in the rear shoe (detail 1) and pushes the ejector plates forward (details 2 and 3). The ejector pins (detail 8) and the sprue ejector pin (detail 6) move forward and eject the moldings

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and the sprue which fall out of the mold into a chute which carries them to the operator who clips the moldings off at the gates.

The mold closes immediately, and the fingers engage the racks which slide in guides. The guides are not shown in the views given. The racks travel back and turn the core assemblies back into molding position. Just before the mold closes completely, the return pins (detail 4) push the ejector back against the rear shoe. The plastics material is then injected through the sprue bushing (detail 15). This sprue bushing is shown flat at the nozzle contact end. It is a variation in design which is used when the nozzle is lifted so its outlet is stopped by the face of the sprue bushing to prevent oozing of material from the nozzle.

Four guide pins and bushings (details 19 and 20) are used to align the mold halves. There is more than the usual amount of lateral force on the guide pins of this mold because of the fingers and racks. The guide pins are made of substantial size to take the extraordinary load. The guide pins have shoulders at the center where they are retained longitudinally by the retaining plate (detail 10) and the backing plate (detail 9). The shoulder was located in this position because the counterbores for all of the other retained parts such as the rear cavities and the sprue ejector bushing (details 18 and 14) are in plate 10 and the counterbore for the guide pin may as well be there too, to save setting up the backing plate for another operation.

The front cavities are retained by the front retainer plate (detail 11) which is bolted to the front shoe (detail 12). The runner system (detail 22) is shown in the right hand view. The rings which mold the threads on the knobs are furnace-brazed into their retainers. The core pins for the knobs are run through the thread ring retainers and are fastened to the rear faces of the gears by flat head screws which are not shown. The sliding ejector pins (detail 8) have enough clearance to provide vents for the air in the mold which moves out when the plastics material enters. It is possible to remove the long sleeve cores and provide clearance grooves longitudinally to let the air escape from the very bottom of the cavities, to assist in filling out the threads.

The construction shown with the ejector and the unscrewing mechanism both in the rear half of the mold is economical in that the sprue is held to a minimum length due to the fact that extra thickness of the front half of the mold is not required to house the unscrewing device. The ejector space is provided by the ejector box spacers (detail 7).

The gears at the ends of the thread ring holders are shown cut integrally with the holders. If desired, the gears may be purchased separately and fastened on with the same screws which hold the core sleeves in place.

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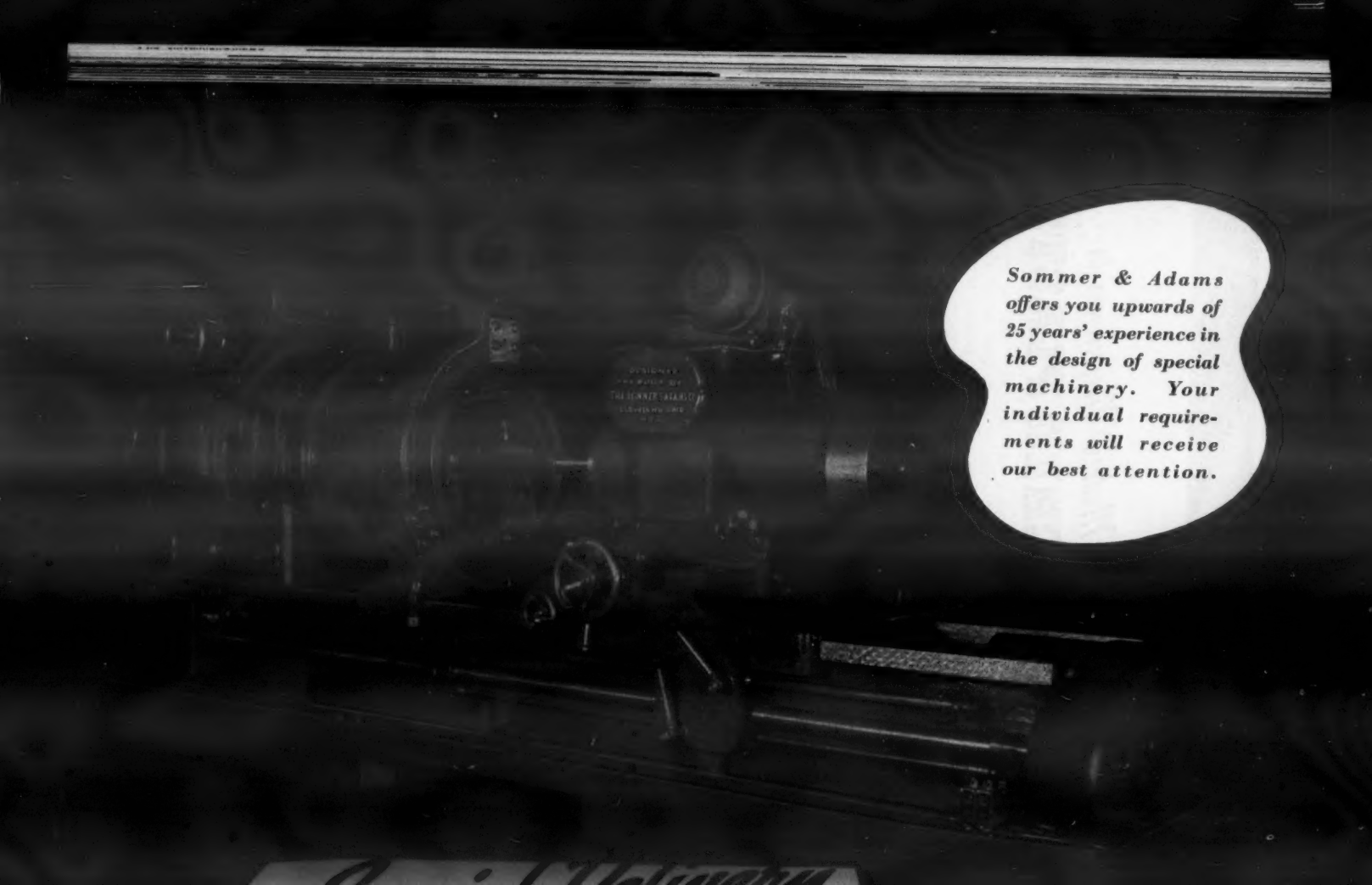
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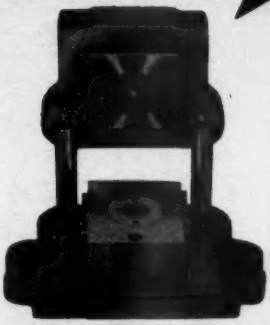

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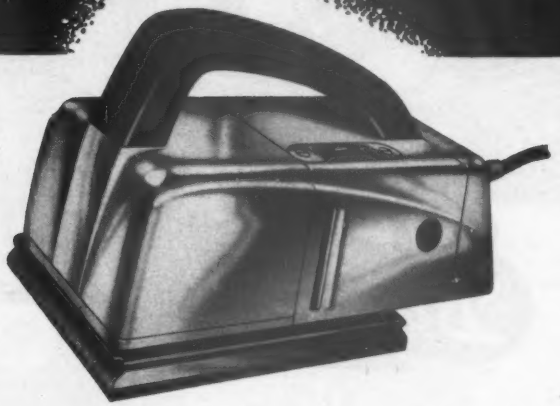

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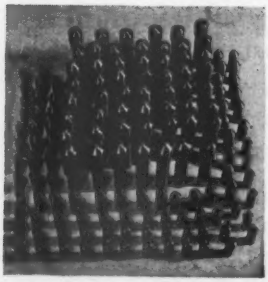

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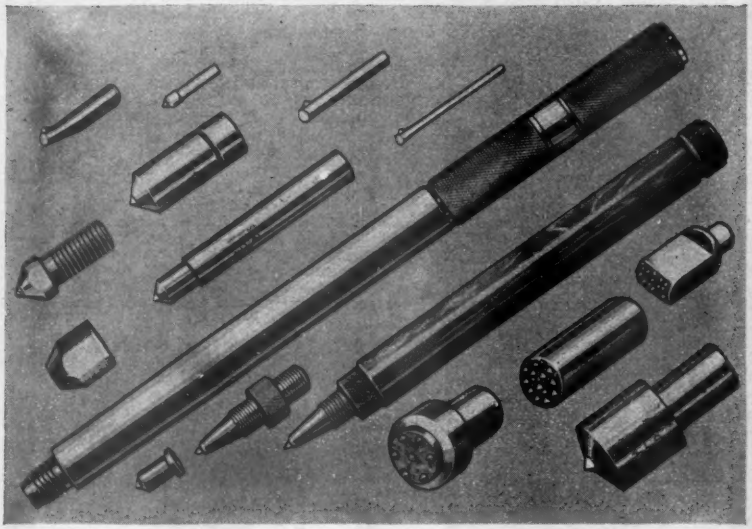

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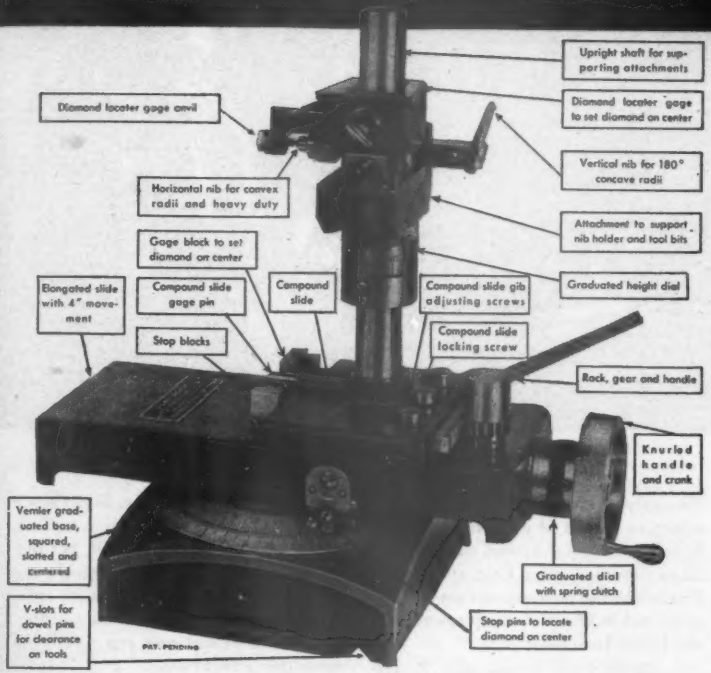
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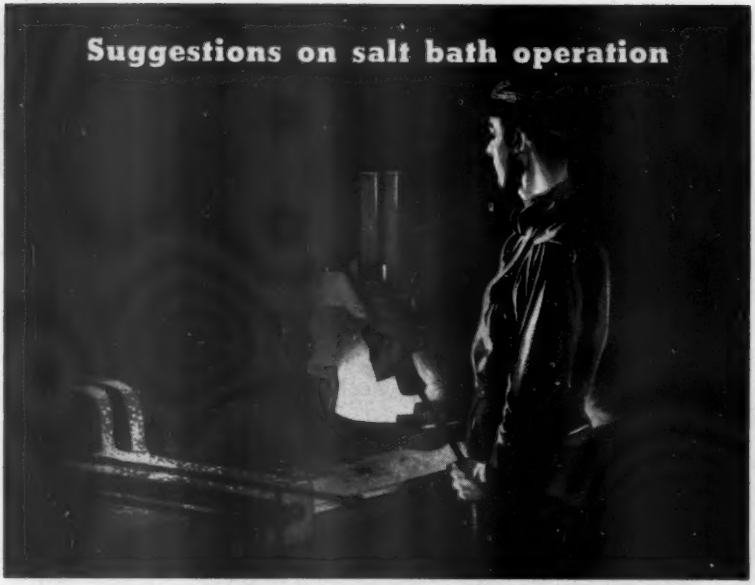

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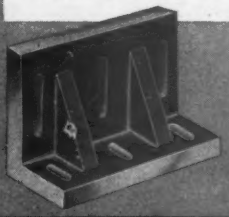

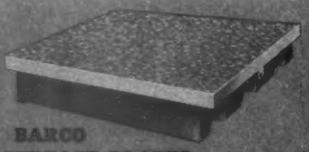

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THE AMERICAN MODEL 2 AUTOMATIC LATHE STOP GAGE—makes lathes semi-automatic, prevents spoiled work, prevents accidents, prevents damage to lathe and chuck, increases production and cuts set-up time, according to a leaflet discussing the features of this gage. It can be quickly installed on Logan, Atlas, South Bend and other lathes. For full details address The American Products Co., Mach. & Tool Div., 2288 Hollers Ave., Bronx, N. Y. **89-B**

A NEW BROCHURE ON COBURN CARRYING EQUIPMENT—advises industry to "save labor by carrying the Coburn way". The bulletin promises that ample stock of standard parts insures prompt delivery. Ways in which the Coburn overhead track can be adapted to meet various plant requirements are described and illustrated. Copies available upon request to the Coburn Trolley Track Co., Dept. T-D, Holyoke, Mass. **90-B**

"CORRECT, PRECISE AND RAPID GRINDING OF THE MOST COMPLICATED—or irregularly formed cutters, or gangs of cutters, requires no particular skill or loss of production time when a Barnes Precision Cutter Grinder is on the job," according to the new Barnes bulletin. The folder gives full details about the construction and performance of the grinder. It will be of interest to purchasing agents and shop superintendents. Copies available from The Producto Machine Co., Dept. J, 990 Housatonic Ave., Bridgeport, Conn. **91-B**

WITH THE CLARK 3-BLADE ADJUSTABLE HOLE CUTTER—exact, clean cut holes can be cut, eliminating boring and reaming, it is claimed, in a new broadside issued by the Robert H. Clark Co., 3422 Sunset Blvd., Los Angeles, Calif. Applications of the cutters to various jobs, instructions for use, specifications and prices are all included. **92-B**

A NEW AND TIMELY DEVELOPMENT—is the Kramer Coolant Cooler. It consists of a spiral fin cooling coil inserted into a steel shell. The unit is provided with a bolted flanged lid for easy removal of the cooling coil for cleaning purposes. The coolant circulates at properly designed velocities by means of suitably spaced baffles. Full details, illustrations, specifications and coolant temperature reduction charts are contained in a new bulletin available from the Kramer Trenton Co., Dept. T, Trenton, N. J. **93-B**

MILWAUKEE SURFACE PLATES, ANGLES AND BOX PARALLELS—are described in Bulletin 108 issued by the J. C. Busch Co., 172 S. Ferry St., Milwaukee, Wis. Accuracy in surface plates is indispensable in the modern tool room and inspection department. This bulletin will be of interest to toolmakers and inspectors. **94-B**

HAMMOND MACHINERY BUILDERS, INC.—1633 Douglas Ave., Kalamazoo 54F, Mich., announce a new bulletin illustrating their cylindrical grinding, polishing and buffing machines. The bulletin gives complete detailed information for finishing of ¼" to 9" outside diameter tubes, rods, bars and a

wide variety of cylindrical shapes. Featured is the relatively standard unit which can be adapted either for use with grinding, polishing and buffing wheels, or arranged for contact-wheel and abrasive belts with Hammond's new patented backstand-idler. Request Bulletin No. 502 from the company. **95-B**

A COMPREHENSIVE CATALOG—published by the Cullman Wheel Co. covers block and roller sprockets, hubs and flexible couplings, block and roller chains, silent chains and sprockets, general information on sprockets, horse power tables, diameter of sprockets, and data on machine tool drives. Copies available on request to the Cullman Wheel Co., 1332 Altgeld St., Chicago, Ill. **96-B**

"HILL" HEAVY DUTY PRECISION SURFACE GRINDERS—which are manufactured in both the vertical spindle and horizontal spindle design are illustrated and described in Bulletin H-V-3 issued by The Hill Acme Co., 6408 Breakwater Ave., Cleveland, O. Copies available on request. **97-B**

A NEW CATALOG COVERING—their finish ground, carbide tipped tools has recently been published by New England Carbide Tool Co., 67 Brookline St., Cambridge, Mass. It covers all dimensions, carbide forms, clearances and prices on their four standard styles of right- and left-hand tools as well as their square and pointed tipped tools. A handy wall chart, covering this same information, is available for tool rooms and purchasing departments. Both are available on request. **58-B**

(Continued on Page 148)

(Continued from Page 147)

"THE LIVERMONT TORQ-SNAP WRENCH"—is the title of a bulletin released by Tubing Seal-Cap, Inc., 220 West Seventh St., Los Angeles, Calif. Each wrench is pre-set to the proper load for the nut it is designed to fit. When desired load is reached, the wrench gives a definite audible "click" and a small tickler taps the operator's hand. **99-B**

COMPUTING ANGLES IS NOW A SPEEDY OPERATION—as explained in Bulletin No. 2 released by The Angle Computer Co., 5726-28 Melrose Ave., Los Angeles 34, Calif. An accurate description of the Studler Angle Computer includes the frame, dials, surface plate, main bearings, adjustment control, care, capacity and specifications. **100-B**

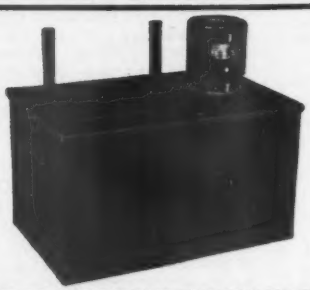
IN ANSWER TO THE QUESTION:—"What do you make?", The Weatherhead Co. has prepared a new catalog supplement for the convenience of engineering, production, designing and purchasing departments. The 8-page supplement is a cross section of five lines of products. In the past, Weatherhead has kept the literature of each line of its products separate, but here is a condensation of items made for the aviation industry—automotive and industrial tube and pipe fittings, refrigeration accessories, the exclusive Ermeto fittings and Marine products. Copies available from The Weatherhead Co., 303 East 131 St., Cleveland, O. **101-B**

NEW LITERATURE ISSUED BY—Colborne Mfg. Co., 159 W. Division St., Chicago, Ill., describes the Colborne Speed Lathes for polishing, grinding, burring, lapping and final operations on gears, dies, gages, small parts and long rods. The specifications list the variable speeds obtainable with the machines as designed, but special speeds and fixtures to meet requirements can be furnished. For further information, write the company. **102-B**

THE AMERICAN GAUGE CO.—126 Bayard St., has issued a new folder illustrating and describing their bench centers, radius dresser thread checkers, lapping plates, amplifying gages and hole checkers. Copies available free on request. **103-B**

A NEW TWO-COLOR WELL ILLUSTRATED BOOKLET—issued recently by the Turchan Follower Machine Co., 8259 Livernois Ave., Detroit, Mich., features hydraulic duplicating equipment capable of being attached to any standard type lathe, planer, shaper, grinder or milling machine. In the booklet, Turchan, builders of all-hydraulic following machines, sets forth the advantages of using duplicators in the machining of parts having irregular internal or external contours such as propeller blades, cams, carburetor parts, casings, rollers, molds and dies. **104-B**

(Cont'd on Page 150)



BRING YOUR OLD MACHINE TOOLS UP-TO-DATE WITH THE EASTERN COMBINATION SELF-CONTAINED PORTABLE COOLANT PUMP—MODEL 16-S

● **This compact, husky new Eastern model is equally suitable for permanent attachment or as a portable unit movable from one machine to another.**

Replaces hand application of coolant with a constant, regulated flow that increases tool life and steps up production on lathes, shapers, milling machines, drill presses, cut-off saws and similar equipment.

SPECIFICATIONS

Tank: 16 gauge steel 16" x 10" x 9" high. Motor height above tank 4⅜".
Weight: 40 lbs.
Pump: 1/30 H.P., 1525 R.P.M. air-jacketed, fan-cooled, totally enclosed 110-V or 220-V 60-cycle, single-phase motor.
Max. Pressure: 4½ lbs. per sq. inch.
Max. Capacity: 3¾ g.p.m.

Write for complete descriptive material and prices.

EASTERN ENGINEERING COMPANY
72 FOX STREET NEW HAVEN, CONN.

COWL RINGS for "fighters"

A McKinney built assembling, locating and drilling jig for speeding production of cowl rings for one of the foremost fighting planes.

thru McKINNEY TOOLING

McKinney precision tooling is stepping up the war tempo — on distant battlefields — in the air — on and under the sea — through outstanding service on the production front.

To the solution of tooling problems, whether conventional, entirely new or uncommonly difficult, McKinney brings decades of experience — a large corps of engineers — hundreds of tool technicians and an extensive plant replete with the finest precision equipment.

McKinney offers — *designing* of tools for production in your own plant — *building* of equipment to your blueprints — or *complete tooling service* from drawing board to finished product.

Send blueprints or ask a McKinney engineer to sit down across the desk to discuss this subject of mutual and timely interest.

McKINNEY TOOL & MFG. CO.
CLEVELAND

DESIGNERS and BUILDERS of PRECISION TOOLING
Since 1920

1673 ARABELLA ROAD

Tools-Dies-Jigs-Fixtures-Special Machinery

(Continued from Page 148)

THE MATTHEWS LINE OF RING STYLE STEEL TYPE HOLDERS—for curved line stamping is illustrated and described in a new leaflet. The development of the Ring Style Holder is the result of careful engineering and designing to provide a marking tool for efficient and legible stamping of war products. The holders are supplied for hand stamping or press use, for marking flat, conical or spherical surfaces. For copies of the leaflet, address Jas. H. Matthews & Co., 3896 Forbes St., Pittsburgh, Pa. **50-B**

THE NEW ALGOMA PROCESS—for manufacturing blank and pierce template dies is described in an attractive new bulletin (T-43) just released by the company. In the Algoma method, the folder states, fabrication of the dies from templates of the parts themselves eliminates special die design, simplifies engineering alterations and saves three-fourths the time and two-thirds the cost of conventional dies. Unique use of rubber compression blocks makes the dies self-stripping and self-ejecting. For your copy, write to Algoma Products, 3083 E. Outer Drive, Detroit 12, Mich. **62-B**

THE NEW ARMY ORDNANCE BOOK ON BATTLENECKS—says "Stop calling them bottlenecks, they are battlenecks. Bottleneck is a passive peacetime word, meaning only a restricted flow of material. In war it means an increased flow of blood . . . when you can't get delivery on machined parts and a gun assembly stops, there is a Battleneck, not a bottleneck, because sailors and soldiers may die in battle for lack of them." The material specifications of present production require the entire flow of many essential metals. In order to increase production the necessary 50% to 100%, enough scarce materials must be taken out of the specifications to provide . . . a supply must be created by saving. This is a vast job of redesigning and adaptation of men, materials and machines. The Ordnance Department, in this booklet, makes citations for various examples of engineering ingenuity that have widened production bottlenecks. Specific suggestions and details on problems already overcome are given. In addition, there is a list of other "production enemies"—a challenge to any homefront fighter to find the solution. For your copies, address Major General T. J. Hayes, Ordnance Department, U. S. Army, Pentagon Bldg., Washington, D. C., or any Ordnance district office.

A THOROUGHLY READABLE, USABLE AND WORKABLE BOOK—is the one published by the Aluminum Company of America entitled "Alcoa Aluminum and its Alloys". Beginning with a section of general information on aluminum, its physical and chem-

(Cont'd on Page 152)

Save critical materials by using DUBLIFE.

A new plug end either "Go" or "No Go" is ready when used end is worn. Instantly reversible. Bronze split collet locks ends in same handle giving you *two gages in one.* Tolerances to 0.00002. UPPCO lapped insures *most lasting* finish.

Catalog shows complete line of superior DUBLIFE Gages

Other Gages of American Gage Design also shown. Write

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3516 West Belmont Ave. Chicago, Ill.

DOALL

MACHINES

Do a Good Job at CONSOLIDATED VULTEE

At the Fort Worth home of B-24 Liberator Bombers and C-87 Liberator Express Transports. At left, Operator Jackson is making a bucking bar from a pattern drawn on a block of cold rolled steel. Above he is cutting sheet aluminum. This is only one of many DoAlls in this modern plant. Jackson has operated this machine for more than 8 months and declares it is invaluable for fast precision cutting and saves both time and metal.

MACHINE OF MANY USES

That's what Consolidated Vultee calls the DoAll, and it's a fact because

★ DoAll does internal and external cutting of metals, alloys, plastics, etc., following a hairline design with unerring precision

★ Cuts out production parts, jigs, dies, fixtures, cams, templates, special tools, etc.

★ Cuts 100 or more shapes at one time from stacked sheets

★ Makes short runs of stampings or forgings

★ Cuts out blocks, sheets, bars or tubing

★ Relieves heavy machine tools for other work

DoAll is on the job on regular production lines, in experimental rooms, tool rooms and repair departments. DoAll smashes bottlenecks—beats former time records—gets jobs through on time.

Investigate this modern machine that does hundreds of shaper, milling and lathe jobs in a fraction of the time.

"DoAll on Production"— Interesting book, well illustrated, about DoAll performance in many plants. Write for copy today.

CONTINENTAL MACHINES, INC.

1303 S. Washington Ave., Minneapolis, Minn.

DoAll Offices in 25 cities, each in charge of a trained sales engineer to give you quick service on Contour Machines, DoAll Band Saws and Files, Gage Blocks and Surface Grinders.

(Continued from Page 150)

ical properties, it covers the various alloys. It gives technical information on wrought alloys, products and heat treatment; and on alloy castings. It discusses the various fabricating practices: forming, hot forming, welding, resistance welding, brazing, machining, riveting and painting aluminum alloys for protection. In addition, there is included a series of 49 valuable tables on aluminum and its alloys: general data, chemical composition, general properties, mechanical properties, specified mechanical properties, commercial tolerances, standard sizes and commercial sizes. Request this book from the Aluminum Company of America, Dept. T-D, Pittsburgh, Pa. Put it to work for you . . . you'll find in it the solution to many of your problems with this remarkable metal and its alloys. **75-B**

BLADES FOR CENTERLESS GRINDERS
. . . TIPPED WITH TUNGSTEN CARBIDE
Assure Greater Production and Accuracy in the finish grinding of bullet cores, armor-piercing shot, shells, projectiles, tank parts, aircraft engine parts, rifle and machine gun parts.
TALIDE
METAL CARBIDES CORPORATION
YOUNGSTOWN, OHIO

A 20-PAGE ILLUSTRATED AIRCRAFT SUMMARY CATALOG—showing 50 new speed nut and speed clip applications that cut assembly time and save weight has been issued by Tinnerman Products, Inc., 2098 Fulton Rd., Cleveland, O. It explains how the speed nut system performs multiple functions by combining two or more parts into one. Maximum load limits for speed nuts of all sizes are listed. Engineering data showing how speed nuts conquer vibration loosening is included. **76-B**

A COMPLETE LINE OF ARC-WELDING ACCESSORIES—for both men and women is illustrated in a 32-page booklet released by the General Electric Company, Dept. D, Schenectady, N. Y. Chrome-leather protective clothing is recommended for arc welding work, because it resists welding heat properly and wears well without being too heavy for comfort. All of the clothing illustrated is stylish and made for cool comfort and protection. Asbestos and Flameproof material is featured in aprons, sleevelets and double-duty mitts. Electrode holders, cable connectors, stamps and brushes are also illustrated and discussed. **77-B**

THE NICHOLS MILLER—is featured in an eight-page bulletin issued by W. H. Nichols & Sons, Dept. T, Waltham, Mass. Details of construction are clearly described and illustrated. A wide selection of attachments can be supplied to add to the versatility of the machine. Further information can be had by writing to the company. **78-B**

EDWARD BLAKE COMPANY—has just issued a catalog covering the operation and new construction features of the No. 1 Blake tap grinder, as well as complete details on the new No. 2 Blake tap grinder. Both machines will sharpen the chamfer on taps from No. 0 to 2" with 2, 3, 4, 5, 6, 8, or 10 flutes, either right or left-hand. The No. 1 grinder has capacity for taps up to 6" long and the new No. 2 for taps

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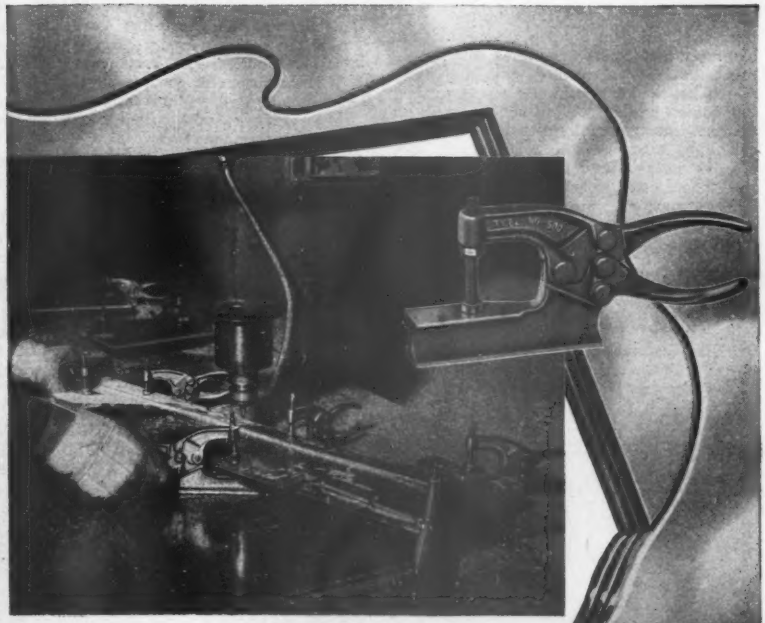

IT'S EASY TO GUIDE A STACK of METAL SHEETS UNDER A ROUTER

when using

KNU-VISE PLIERS

MODEL KL-500

With the lower jaw shaped like an anvil, these pliers can securely hold a stack of metal sheets together for routing operations. The top and base are wide and flat (ground within .001 inch in accuracy), and enable operator to steer work around with great ease.

Let us tell you how we are helping manufacturers simplify operations where clamping is involved.

BUY WAR BONDS

KNU-VISE
INCORPORATED

1330 Plum Ave., Detroit, Mich.
4328 San Fernando Rd., Glendale, Calif.

(Continued from Page 152)

up to 14" long. This catalog covers such new standard and optional features and attachments as the new locating arm and finger which keeps the locating finger always on the center line of the grinding wheel; an optional attachment for grinding quantities of 2-flute taps; special collet chuck spindles for holding round shanks up to 1½"; dust hood over relief mechanism; special OD tailstock for multiple-flute drills and reamers, etc. Free copies of catalog No. 5 will be sent on request. **78-B**

"445" TWO-SPINDLE DEEP HOLE CLYINDER BORING MACHINE—is described in a five-page circular released by the W. F. and John Barnes Co., Dept. H, Rockford, Ill. Its specifications are presented in a detailed diagram of the machine. The base of the machine is cast in two sections with three ways running full length. The head section of the base has tee slots milled into the center way for clamping the headstocks, roller steady-rests and tool guide bushing brackets to the ways. All way-mounted members are clamped to the outside ways by gibs bolted to the underside of each member. **80-B**

RECLAMATION OF DEFECTIVE CASTINGS—is discussed in a four-page leaflet issued by the Eutectic Welding Alloys Co., 46 Worth St., N. Y. C. This new method is the Castolin Eutectic low temperature welding process which is used with your oxy-acetylene torch or your arc welding equipment. Castolin Eutectic rods and their corresponding autochemic fluxes are described in the leaflet which is especially edited to show what can be done by this process in the salvaging of these castings. **81-B**

Sheldon BBU-1240 WQ Precision Lathe

This quality 12 in. ball bearing tool room lathe is built for precision work and will retain its accuracy under long and hard usage. It has extra collet capacity (to 1" round), the finest precision ball or roller bearings obtainable, an improved heavy-duty, double wall apron with power cross feed; full quick change gears and full bowl headstock. Its improved Sheldon 4-speed, V-belt, lever-clutch operated, underneath motor drive is entirely enclosed in the pedestal leg and has anti-friction bearings. It is so designed that spindle belts operate thru a *standard* 1-piece bed. This bed is bridge-braced with heavy cross girts and has hand scraped ways—2 V-ways and 2 flat ways.

If interested in 10", 11" and 13" quality lathes be sure to see the SHELDON.

SHELDON MACHINE CO., INC.
4236 N. Knox Ave. Chicago, U.S.A.

RECLAMATION OF CARBIDE TIPPED CUTTERS AND WORN OUT HSS CUTTERS—is the theme of a six-page bulletin, GT-157, issued by The Carboloy Co., Inc., Dept. C, Detroit, Mich. Included in this bulletin is detailed information on the procedure to be followed in various operations such as utilizing carbide tips which have been broken or worn undersized, removing carbide tips from steel shanks, both silver and copper soldered, reclaiming worn out high speed steel cutters by brazing carbide tips on the cutting edges and detailing carbide tip to shank brazing procedure. **82-B**

"SUB-ZERO" AND "TROPIC" TEMPERATURES—for every requirement are featured in a 36-page booklet issued by the Kold-Hold Mfg. Co., Dept. J, Lansing, Mich. This booklet has been compiled to call attention to the many applications of sub-zero and high temperatures in war work. Specifications are discussed in detail. **84-B**

(Cont'd on Page 156)

Truly Universal Tapping Machines

offer you many advantages!

For tapping jobs that require unusual accuracy and a high rate of production — or for a set-up that involves a wide range of sizes, materials and shapes — this new PROCUNIER "Universal" Tapping Machine is ideal.

All adjustments can be made quickly and easily — such as regulating compensating spring pressure, setting depth stop, changing to any of the four speeds from 390 to 2050 RPM, or adjusting timing or flow of tap lubricant. Extra long compensating springs assure uniform tapping and reversing pressure independent of operator. Tap establishes its own lead for greater accuracy. Automatic tap lubricator provides abundant supply exactly when needed. Motor-driven continuous flow lubricant pumps also available. Has exclusive Procunier high-speed tapping head with double-cone friction clutch and TRU-GRIP tap holder which has many advantages. Many other features.

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giving full details and prices on Procunier Universal Tapping Machines, High Speed Tapping Head and Tru-Grip Tap Holder.

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12-14 S. Clinton St., Chicago, Ill.

Send me bulletin on: ☐ Universal Tapping Machines ☐ High Speed Tapping Heads ☐ Tru-Grip Tap Holder.

Name.....

Address.....

City.....State.....

MAIL THIS COUPON TODAY!

(Continued from Page 154)

CENTRIFUGAL PUMPS are described in condensed Catalog No. 742 issued by Economy Pumps, Inc., 1005 Weller Ave., Hamilton, O. Tables and illustrations are included in the descriptions of clear liquid pumps, sump pumps, sewage pumps, and axial flow pumps. **98-B**

SPEED, POWER AND ACCURACY—describes the only Triway Boring Machine built and is the theme of an eight-page leaflet issued by the Universal Boring Machine Co., Dept. T, Hudson, Mass. This horizontal boring machine is offered in a standard speed range, 16 to 650 rpm and a special high speed range of 15 to 1200 rpm. There are no overhanging parts as all units are so mounted that they are directly on the base, thus insuring long life. The entire machine, including head counterweight, is above floor line. **111-B**

THE PORTER-McLEOD MACHINE TOOL CO., INC., Dept. G, Hatfield, Mass., has issued several leaflets describing their eight-inch cold metal sawing machine, one-inch wet abrasive cutting-off machine and their 16-inch 12-speed geared head-quick change screw cutting engine lathe. **112-B**

THE POTTER & JOHNSTON MACHINE CO., Dept. H, Pawtucket, R. I., has just released a complete set of catalogs covering their line of Power-Flex automatic chucking and turning machines. These catalogs include a general description, photographs and diagrams. **113-B**

WITH THE VARIETY OF ATTACHMENTS—available for the Greenfield No. 4 tool and cutter grinder, there is hardly a grinding operation that cannot be handled within its capacity. For the toolroom or die shop, the grinder is an excellent investment which pays for itself in many ways, it is claimed. Bulletin No. 2 shows how this machine can be used as a plain cutter and reamer grinder or as a universal type grinder. Complete specifications and interesting illustrations showing the grinder in use are included. Address Production Machine Co., Greenfield, Mass., or write us for a copy. **105-B**

ROUSE HAND MILLER—a high speed ball bearing motor driven machine made for handling light cuts in brass, aluminum and similar materials is described in a broadside issued by H. B. Rouse & Co., 2210 N. Wayne Ave., Chicago. **106-B**

MACHINE TOOL COOLANT AND INDUSTRIAL CENTRIFUGAL PUMPS are illustrated and described in a six-page bulletin issued by Brady-Penrod, Inc., Dept. T, Muncie, Ind. These pumps are used as standard equipment on many machine tools—degreasers, quench tanks, internal and external grinders, milling machines, lathes, turret lathes, honers, drill presses, circulating and sump work. **114-B**

(Cont'd on Page 158)

How to TRAIN Tool Makers FASTER!

● Widely used throughout industry and trade schools, "Tool Steel Simplified" meets the urgent need for a complete, up-to-date text for training new men, "refreshing" older men, or trouble shooting in the tool room. Tells in easy shop language how to select tool steel, how to make tools, how to improve tool performance. It is available *at cost*, $1.00 per copy, to tool steel users in the U. S. A.

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315 *Pages* 205 *Illustrations*
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Please send me postpaid a copy of "Tool Steel Simplified." I enclose $1.00 ($3.50 *outside the U. S. A.*) *in full payment for the book.*

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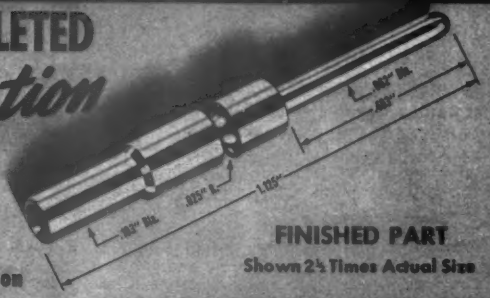
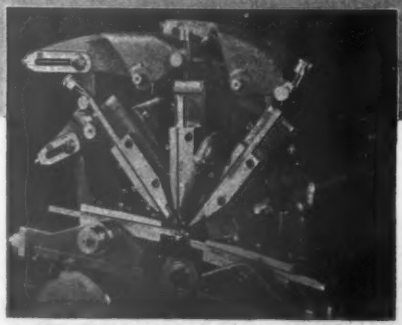
THIS PART COMPLETED *in One Operation* IN LESS THAN 9 SECONDS



FINISHED PART
Shown 2½ Times Actual Size

Tolerances Held Within ± .0005 on

GORTON 16-A *Precision* AUTOMATIC



The 5 actual cutting tools used to produce this job, shown in position on the Gorton 16-A 5-Station Multiple Tool Head.

The accurate, high speed production of this precision part is simple and highly efficient on the Gorton 16-A. Only this tooling is required: 6 cams, 5 cutting tools, 1 drill, 2 collets and 1 bushing. Drilling of hole is accomplished with attachment mounted ahead of cutting tools.

Tolerances on all dimensions are held within ±.0005"; extremely high finish is maintained. Seven pieces are produced per minute with spindle speed of 8700 r.p.m. and surface speed of 290 f.p.m. Material is ⅛" round free-cutting brass.

IN *1* OPERATION
TURNS, CENTERS, DRILLS, THREADS, SLOTS

The Gorton 16-A mass-produces an almost endless variety of short or long slender parts — simple or complex — complete in *one* operation. It does step and contour turning and chamfering in multiple diameters — tapers, knurls, bevels, back recesses, pivot points, etc.

Extreme accuracy and unusually high finish are maintained; second operations often eliminated. Maximum accessibility of all vital parts and controls insures simplicity of set-ups and operation.

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GET THE FACTS NOW

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GEORGE GORTON MACHINE CO.
1319 RACINE STREET, RACINE, WISCONSIN, U. S. A.

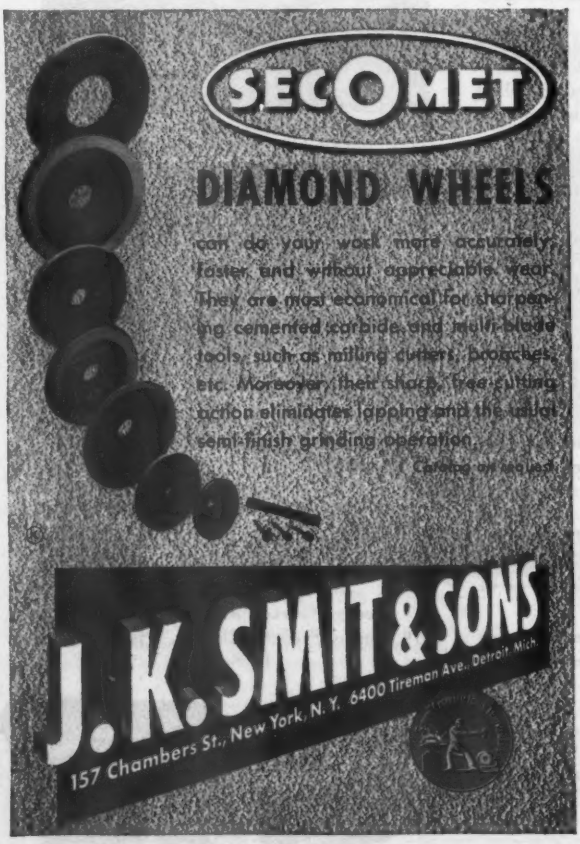
(Continued from Page 156)

FITCHBURG "TYPE C" ADJUSTABLE ANGULAR HEAD GRINDING MACHINE—is described in detail in an eight-page folder released by the Fitchburg Grinding Machine Corp., Dept. G, Fitchburg, Mass. This newest of Fitchburg plain cylindrical grinders has a Standard Wheelhead Unit mounted so that it may be located to grind from 0 degree up to a 45-degree angle. Its Bowgage head is adjustable and can be swiveled to various positions for standard plain grinding, thus providing greater grinding utility. **115-B**

MOTOR TOOL LIVE CENTERS—is featured in a four-page leaflet issued by the Motor Tool Mfg. Co., 7780 Cortland Ave., Detroit, Mich. Differing from tail stock, stationary centers, they rotate with the work—will not burn out the center or the work regardless of how long or continuous the run, if operated at their rated load. They revolve on both ball and roller bearings of sufficient capacity to carry unusually high thrust and radial loads. A table of thrust and radial load capacities is shown. **124-B**

SCRAPERS, MADE FOR MECHANICS—for the Metal Working Industry are featured in a four-page catalog, issued by Murcott & Campbell, Inc., 587 Union Ave., Brooklyn, N. Y. These scrapers are made by forging and grinding, from a very high carbon steel, specially heat-treated to produce the maximum hardness and fineness of grain, thereby assuring the greatest wearing quality and keenness of edge. **125-B**

SHORE'S STANDARD RECORDING SCLEROSCOPE—for measuring the hardness of metals is described in Bulletin S-30 issued by the Shore Instrument & Mfg. Co., 9025 Van Wyck Ave., Jamaica, N. Y. The Scleroscope hardness indicator is 100% portable; it can be carried to the work when heavy, moved about thereon and used free handed. It also is adapted to testing small and very thin specimens. **126-B**


SECOMET
DIAMOND WHEELS
can do your work more accurately, faster, and without appreciable wear. They are most economical for sharpening cemented carbide and multi-blade tools, such as milling cutters, broaches, etc. Moreover, their sharp, free-cutting action eliminates lapping and the usual semi-finish grinding operation.
Catalog on request
J. K. SMIT & SONS
157 Chambers St., New York, N. Y. 6400 Tireman Ave., Detroit, Mich.

VARIETY OF ATTACHMENTS MAKES MACHINE UNIVERSAL GRINDER—The No. 4 Cutter and Reamer Grinder is discussed and illustrated in an eight-page folder released by the Production Machine Co., Dept. J, Greenfield, Mass. With the variety of attachments available for this machine there is hardly a grinding operation that cannot be handled within its capacity. **127-B**

A SMALL GRINDER FOR FUSSY LITTLE JOBS—is the Sanford High Speed Surface Grinder, described and illustrated in a four-page leaflet issued by the Sanford Mfg. Co., 1279-81 Springfield Ave., Irvington, N. J. This grinder is specially designed for small work requiring highest accuracy and finest finish. **128-B**

NEW HIGH EFFICIENCY CUTTER
SLASHES MILLING COSTS . . .

HERE'S money-saving news for production men! Faster milling with better finishes and greater accuracy . . . . *at lower cost!* That sums up the advantages of this new carbide tipped milling cutter by Super Tool Company.

It's fast! Feeds of .002" to .005" per tooth in cast iron and non-ferrous materials at machine capacity. Surface speeds of 400 to 800 feet per minute with tooth loads of .0005" to .0025" in steel—table feeds of 5" to 18" per minute.

It's accurate! Faster operating speeds mean less cutting pressure with less distortion of work. And the high speed of this cutter produces a fine finish comparable to a ground finish.

Most Sizes Available for Immediate Shipment NOW— others in two to three weeks

It's economical! Initial cost is lower. It produces more and better work—faster. And it is designed to be used for slotting, side milling, face milling or half side milling without alteration.

May we send you a descriptive folder giving prices and full details?

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SUPER TOOL CO.

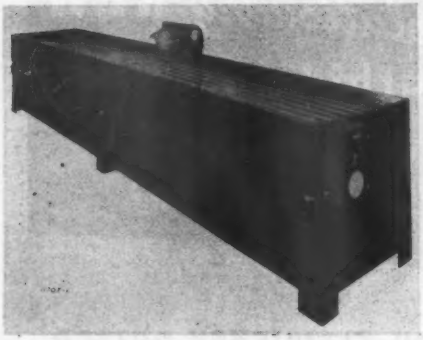
21650 Hoover Road
Detroit 13, Mich.

★

4105 San Fernando Rd.
Glendale 4, California

Carbide Tipped Tools

Test Pressure Bench Can Service Two Operators



VARIABLE test pressure of 0 to 10,000 lbs. per square inch and a variable delivery pumping unit of 0 to 12 gallons per minute is available in stationary Hydraulic Test Bench Model T-102 of the Hydraulic Machinery Co., Inc.

Principally used for checking aircraft tubing, the bench can be used by two operators at a time with a third working off the accumulator hook-up in an emergency.

The accumulator is used for checking aircraft valves and can be operated at a maximum test pressure of 1000 lbs. per square inch. An air-oil accumulator—the air part of it being charged by a small hydraulic driven high pressure air compressor—it can be used to charge the accumulator on the planes themselves.

Hydraulic Machinery Co., Inc., 12820 Ford Rd., Dearborn, Mich., will send details. 116-B

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Priced from $9.75 up

More than 2700 war plants now use thousands of TRICO MICRO-CHEKS to speed up the gaging of millions of precision parts. With it, inexperienced workers quickly become dependable inspectors. Our new booklet shows many further uses of this accurate, speedier gage. Write for this timely information.

TRICO

TRICO PRODUCTS CORP.

Room 125 Trico Building, Buffalo, N. Y.

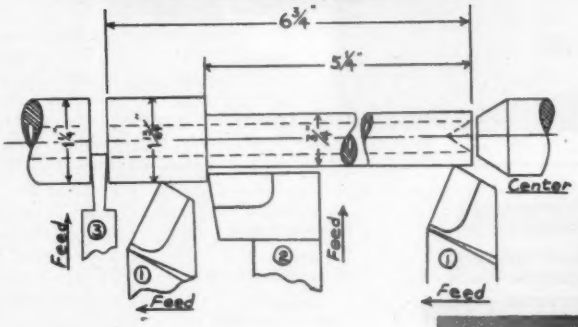
Non-Tangle Box For Saws

A REAL improvement in the packaging of Capewell contour saw blades has been announced. A specially designed solid box that prevents tangling of the blade is now being substituted for the cardboard boxes heretofore used.

With the new boxes, the blades, packed 100 feet in a coil in all widths up to ½", can be drawn out in amounts as needed, unbent and untangled.

Capewell Mfg. Co., New Haven, Conn. 117-B

KENNAMETAL*
Outproduces Other Carbides in Cutting *Stainless Steel*



● **KENNAMETAL** again gives the top steel-cutting performance on a tough job!

In an actual shop run **KENNAMETAL** turned 12 pieces of stainless steel tubing at 920 rpm and 2 more pieces at 1480 rpm in comparison with 8 to 10 pieces per grind by competing carbides. Only with **KENNAMETAL** was this job machined without appreciable loss of size.

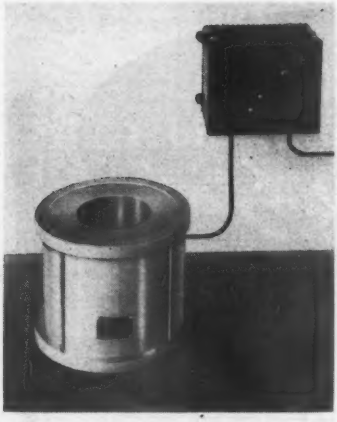
The material was 18-8 stainless steel tubing (2.5 manganese). The operation employed feeds of—tool No. (1) .010"/Rev., tool No. (2) hand feed, tool No. (3) .004"/Rev. The tools that were used in this operation are illustrated.

For boring, turning, and facing to close tolerances use **KENNAMETAL** steel-cutting carbide tools.

Write for your copy of the **KENNAMETAL** Tool Manual. It contains information on the handling and proper use of steel-cutting carbide tools.

KENNAMETAL Inc.
500 Lloyd Ave., Latrobe, Pa.
Trade Mark Reg. U. S. Pat. Off.
Foreign Sales: U. S. STEEL EXPORT CO., 30 Church St., New York (Exclusive of Canada and Great Britain)

KENNAMETAL THE All American CARBIDE



Heat Treating Furnace for Tool Room Use

FREQUENTLY operations are held up in the tool rooms for long periods while a small tool, punch, gage, jib, bushing or other small part is routed to another department or sent outside for heat treating. The versatile new Lee Cub tool hardening and carburizing furnace can effectively overcome this cause of delay.

Because of the convenience and time-saving features of this compact, electrically-heated bench unit, many manufacturers find it advantageous to install several throughout the plant, equipping every tool room with its own heat treating facilities.

The Lee Cub furnace is particularly designed for use with accelerated carburizing salts. Maximum hardness without warping is easily secured. The Cub will operate at a maximum temperature of 1600° F. Regulation of the temperature for hardening carbon steel parts is provided by the control unit furnished as standard equipment with the furnace.

The furnace can be operated intermittently or continuously on any 110-130 volt circuit and, being electrically heated, the temperature remains constant. The salt is uniformly heated even when the level of the bath varies widely. Uniform temperature minimizes decomposition of the salts.

For further information, write to Industrial Furnace Division, Lee Grinder Co., 4705 Armitage Ave., Chicago, Ill. 118-B

BOKUM TOOLS

Accept More Feed—Increase Production

Since the greatest cutting force is always directed toward its largest cross section, the Bokum Tool can accept more feed than ordinary boring tools; therefore, it completes the job faster.

Original form of tool is never changed through resharpening.

For complete description of these tools send for the catalog that meets your particular needs.

For Super High Speed Tools, No. E-1139

For Carbide-Tipped, No. E-398

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BOKUM TOOL CO.

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Retracting and Repositioning Work Within .0002 OF AN INCH—By Push Button

The most frequently needed function in a precision boring machine is that of retracting the work to facilitate measuring and tool setting.

In the DeVlieg Jigmil, this function is automatic—by fingertip control. Operation of a push button unlocks the table and moves it by rapid traverse to the desired position for measuring. For repositioning, operation of a single push button will cause the table to return to its cutting position by rapid traverse, stopping and locking automatically. Uniformity of selected position for stopping and locking is dependable within .0002".

The DeVlieg Jigmil is a new type machine—has the spacing accuracy of a Jig Borer—Performance Qualities of a Milling Machine—Convenience and Flexibility of a Horizontal Boring Mill. All control is so centered and organized that the operator never has to take his eyes off the work.

Thus, the Jigmil fulfills the machine tool ideal—a powerful and accurate extension of the operator's hand.

Many machines show 75 per cent greater average daily productivity.

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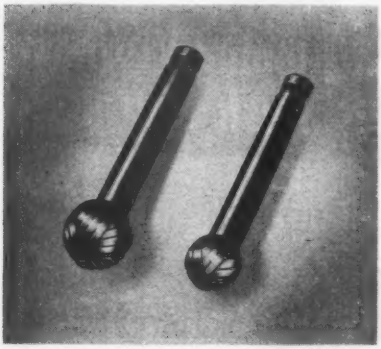
DEVLIEG MACHINE TOOLS

Carbur Developes New Cemented Carbide Burring Tools



AFTER five years of research and development work in the grinding and forming of cemented carbide, Carbur, Inc., announces the production of cemented-carbide burring tools (rotary files).

The tools, to be known as Carburs, have cutting teeth which are ground from the solid on special machines designed and built expressly for this company. The cemented-carbide heads are securely attached to the steel shanks by a new process employed by Carbur.

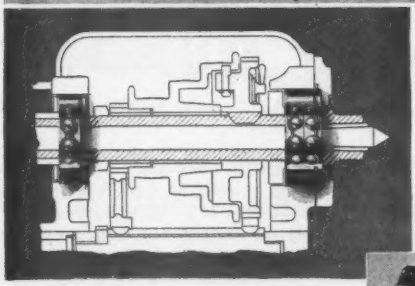
Providing a sharp cutting edge over a long period of time, these tools reduce burring time per part and generally increase efficiency in burring operations in all types of production. Because of their wear-resistance, less replacement is necessary with Carbur, and inventories of burring tools can be reduced considerably. Tool sharpening is reduced in proportion to the life of the tool. Carburs can be run at very high speeds, another factor in reduction of finishing time.

At present, Carburs are supplied only in ball end types in ⅜" and ½" sizes. These dimensions refer to the diameter of the carbide ball ends. The shanks are .250" diameter and the burring tools are 2½" over-all.

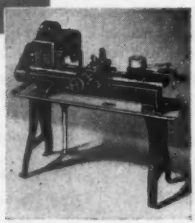
For further information write to Carbur, Inc., Dept. T-D, Lincoln Park 25, Mich. 119-B

SUSTAINED *Spindle Accuracy!*

☆ A FINER FEATURE OF LOGAN LATHES



★ NO. 850 MANUFACTURING TURRET LATHE



Precision, Pre-Loaded Ball Bearing Headstock is Standard Equipment

To assure sustained spindle accuracy on Logan Lathes, the headstock is equipped with precision, "pre-loaded," New Departure Ball Bearings. This pre-loading prevents cutting tool pressure, either radial or thrust, from causing more than a negligible deflection of the spindle. Being grease sealed, as well as pre-loaded, the bearings require no lubrication or adjustment during their entire life. This special ball bearing equipment permits higher operating lathe speed, enabling the user to take every advantage of modern, high speed cutting methods. Thus, production can be increased and unit costs reduced.

Brief Specifications:
- Swing over bed 10½"
- Bed length . . . 43⅛"
- Spindle hole . 25/32"
- Precision ground ways; 2 prismatic V-ways; 2 flat ways.
- 12 spindle speeds, 30 to 1450 per minute.

Write for catalog sheets.

LOGAN ENGINEERING COMPANY
CHICAGO, ILLINOIS

Logan

A NAME TO REMEMBER WHEN YOU THINK OF LATHES

★ More and more, Jessop high speed tool bits are being specified by the men in the shops. They know that no matter what the requirement may be, Jessop makes a steel that will do the job.

Tool bits in specified analyses receive the same careful quality control through each manufacturing process that is afforded to every Jessop product. They are regularly furnished hardened unground in standard lengths with 30° bevel on each end in these popular grades:

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PURPLE LABEL EXTRA • SUPREMUS • MOGUL

ARMY E NAVY

JESSOP STEEL COMPANY
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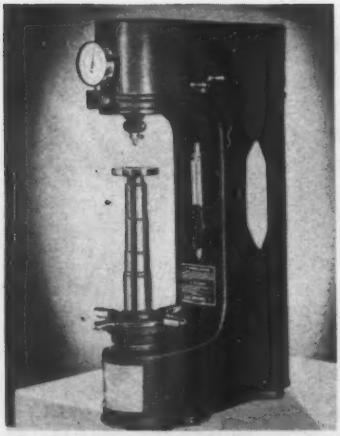
WASHINGTON • • • PENNSYLVANIA Established 1901



New Hardness Tester Speedy, Accurate

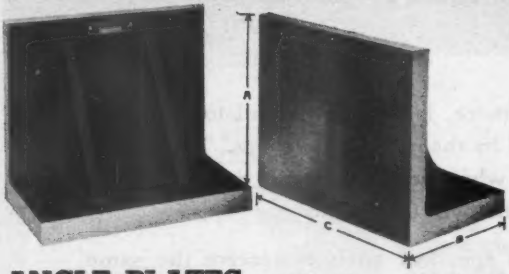
CLARK Instrument, Inc., announces an improved hardness tester for "Rockwell testing" in three models—US8, US12 and US16. The instrument is said to embody a number of features contributing to accuracy of measurement and speed of operation. Among these are a frictionless spindle which provides a correct minor load at all times; Zero Drag Trip which eliminates friction or drag on the loading beam, insuring consistent accuracy of the major load; a dial indicator adjustment affording a convenient, simple means of maintaining accuracy of readings; and a minor load adjustment.

Other outstanding features of the instrument are fully enclosed elevating screw with self-lubricating oil reservoir, and an adjustable steady rest. The instrument is supplied complete with diamond cone penetrator and steel ball penetrators for "Rockwell testing" on "C" scale, "B" scale and most other standard Rockwell scales.

Three anvils are included: a standard 3½" anvil for large flat bearing surface work; a spot anvil for most standard size pieces and for use with test blocks; and a "V" anvil for testing round and cylindrical parts. These are in addition to the two smaller "V" anvils that form part of the adjustable steady rest.

For full information write Clark Instrument, Inc., 10200 Ford Rd., Dearborn, Mich. 120-B

Specify CHALLENGE
SURFACE PLATE EQUIPMENT



ANGLE PLATES . . . Provide a practical and versatile method for clamping and holding work. Challenge plates are made of high grade, fine-grained semi-steel—special heat treated and precision ground to an accuracy of .0005-inch. Made in 22 sizes, from 2½x6x12 inches up to and including 18x18x18 inches. Write for complete information and prices.

PARALLELS: Solid or box. Special heat treated and precision ground to an accuracy of .0005-inch.

V-BLOCKS: Made of fine-grained semi-steel castings. Special heat treated, precision ground. Ribbed sides.

STRAIGHT EDGES: Scientifically shaped and ribbed to retain accuracy. Made of special anaylsis semi-steel.

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THE CHALLENGE MACHINERY CO.
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Simple Design . . . Precision-Built . . . Heavy Duty Ball Bearing for Greater Thrust Load . . . Heavy Duty Roller Bearing for Greater Radial Load . . . Needle Bearing for True Running . . . Large Spindle . . . Small Head . . . Short Overhang . . . Locking Feature for Redressing Point without Disassembling . . . Lubricated—with Oil Seal Lubricant Retainer . . . Cork Thrust Pad Compensator for Expansion of Work

MOTOR TOOL LIVE CENTERS

are as nearly FRICTION-FREE as scientific engineering can make them

Chances are you will wear out a dozen "dead" centers before you even have to dress the point of a MOTOR TOOL. And, in a MOTOR TOOL, there still are years of service if run at rated loads and speeds.

a vital point to keep in mind when buying centers

MOTOR TOOL MANUFACTURING CO.

METAL CUTTING TOOLS

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Make it a Rule to Call Motor Tools

Oakite Releases Special Service Report on Safety

FROM the standpoint of insuring greater protection to the worker, the care and maintenance of such safety devices as respirators, goggles, face and eye shields, welding helmets, rubber gloves, etc., are today receiving careful attention from safety-minded metal-working plants everywhere. A new, 5-page Special Service Report, just issued by Oakite Products, Inc., New York, N. Y., gives timely, practical information on this subject.

After pointing out the necessity for providing adequate facilities for maintaining personal safety equipment, the report discusses the equipment and materials required for effectively carrying out such a program. The four essential steps in handling maintenance of respiratory and other equipment are described, together with recommendations and detailed instructions.

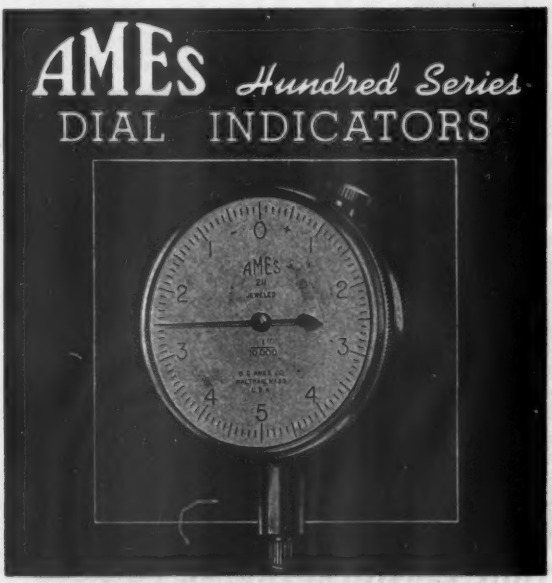
Since there is considerable variance in the design and construction of respirators and goggles, special care must be taken when cleaning sensitive metal and rubber parts. It is pointed out, for example, that strong alkalis should be avoided for cleaning aluminum and aluminum alloy parts of safety equipment. Rubber parts, because of their particular sensitivity to strong solvents, grease, oil, etc., should be cleaned with mild detergents.

Methods for care and maintenance of goggles, helmets and shields of both plastic and metallic construction, hose masks and rubber gloves are also discussed. The report cautions against the use of strong alkalis or solvents when cleaning fibre helmets with special varnish or lacquer finishes for the reason that such materials may remove these protective coatings.

Before chemical treatment is applied to the glass shields in welding hoods to lessen breakage and prevent slag adherence, glass surfaces should be free from oil, grease, paint, etc. A fast, effective method is outlined for putting glass in this condition.

The subject of germicidal treatment of respirators, goggles, etc., by several different methods is also discussed.

Copies are available. Write to Oakite Products, Inc., 57 Thames Street, New York, N. Y. 121-B



Made to A. G. D. specifications in four sizes with fourteen different dial numberings indicating thousandths, half and tenths of thousandths inches. Plain or jewel bearings. Shock absorbers for all models.

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GIRLS IN 'TEENS

are handling jobs in "tenths"!

Aluminum Aircraft Link "produces high finish without bell-mouthing."

Inner Bearing Ring "Accurately removes last 'tenth' of stock."

Bronze Valve. The Sunnen method of honing is used to secure a high finish and accuracy.

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Aviation Hydraulic Cylinder made of Aluminum-Alloy. Improves the quality of the bearing surface. An extremely smooth surface-finish is secured.

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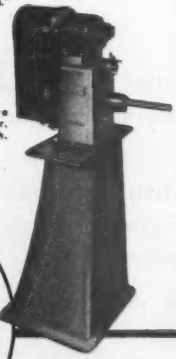


and they can be trained in a few hours.

The guaranteed accuracy (.0001") and super-smooth finish (2 to 3 micro inches) assure fewer rejects and interchangeability of parts.

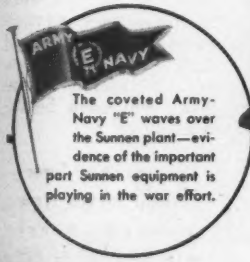
Low in Cost — Economical to Operate

The basic price of the Sunnen Precision Honing Machine is only $195! And it's economical to operate.

No jigs or fixtures — work is held in hands. Relieves big internal grinders for other jobs.

Wide range — handles any internal diameter from .185" to 2.625".

Find out what Sunnen equipment can do for you on your job — one of our engineers will be glad to call and help you solve your problems. Or — if you prefer — write for free bulletin giving complete information.



The coveted Army-Navy "E" waves over the Sunnen plant—evidence of the important part Sunnen equipment is playing in the war effort.

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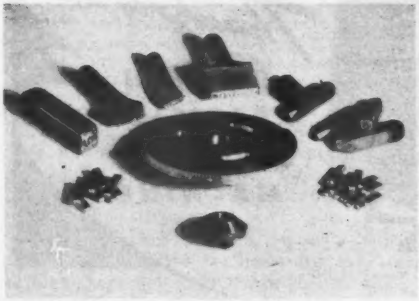
"New Method" Meets Increased Demand For Marking Devices With Expansion



IN taking over the quarters recently vacated by the Colonial Broach Co., New Method Steel Stamps, Inc., expanded its facilities more than twofold in an effort to keep pace with the increased demands for marking devices carrying a wide variety of numerals, letters and symbols.

New Method's most extensively expanded facilities are those provided for cutting special letter and symbol stamps, precision graduation marking of collars, rings, etc., and the engraving of more or less complicated designs in steel for embossing operations, trade mark impressions, roll marking and similar work. In addition to this, the company will manufacture a broadened line of standard stamps, inspector's stamps, etc.

While steel dies are used for initially forming some standard sizes and types of numeral stamps, most stamps require the use of pantographic engraving machines. All stamps are subsequently finished by hand bench work. The equipment available for this work is now four times greater than required about two years ago, and additional equipment will soon be installed.

For further information write New Method Steel Stamps, Inc., 147 Jos. Campau, Detroit, Mich. 122-B

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The E. C. No. 5 V Vertimil, because of its scope and capacity, embraces the requirements of a highly diversified type of industry. This is evident from the enthusiastic comments of the engineering personnel of companies engaged in machine tool manufacturing, ship building, munitions work, plastics and moulding, die casting and wherever precision tool and die work is of utmost importance.

Extraordinary? Noteworthy E. C. 5V features include a swivel head with sliding spindle which tilts 45° to either side, its movable ram which permits milling more than 30" from column, a tilting table which permits tilting 30° toward or away from column, its 4-way power feed mechanism which includes cross and longitudinal table feeds, vertical, knee feed and power fed spindle!

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TOLHURST chip wringers apply a purely mechanical method of separating the oil from chips—centrifugal force. Efficient application of this force, in the correct degree, insures maximum oil recovery and low operating costs.

The wringers recover up to 97% of the cutting oil on chips and turnings. The volume of oil which can be recovered depends to some degree upon the type of chip, the kind of metal, the type of oil and certain other factors. In the average plant, the yield runs between the extremes of 50 gallons from every 1,000 lbs. of chips to 10 gallons. A typical yield is about 19 gallons per 1,000.

The general design of the Tolhurst wringers presents several important features. Motor-driven units are especially designed for low starting-current requirements and the motors are always separate units. The means of supporting the revolving basket permits it to gyrate, if the load is not perfectly balanced, so that vibration cannot be transmitted from the basket to the machine foundation. Provision is made for dampening out basket gyration when it occurs. Positive bearing alignment is assured by the basic design of the machine.

For full details, address American Machine and Metals, Inc., Tolhurst Centrifugal Division, 106 Sixth Ave., New York, N. Y. 123-B

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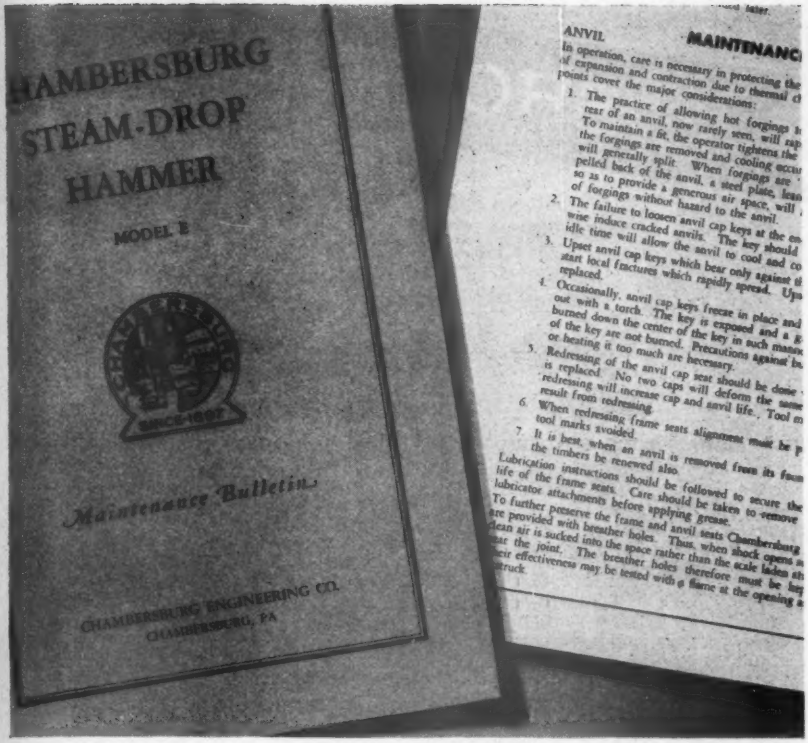

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DROP FORGINGS are more essential today than ever before. Millions of forgings per year are needed for the aircraft program alone. Production of hammers at Chambersburg is at an all time high . . . Yet more are needed. Older hammers must therefore do more than ever . . . must last longer. There are many ways to get more out of your hammers . . . perhaps you can get some new ideas out of our Model "E" Steam Drop Hammer Maintenance Book . . . Write for a copy . . . even if your hammers are *not* Chambersburgs.

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HAMMERS DROPSTAMPS PRESSES

SHOP AIDS

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NEW HINMAN BOOK PUBLISHED—C. W. Hinman, a regular Tool and Die Journal writer, announces publication of his latest book, Die Engineering Layouts and Formulas, by McGraw-Hill Book Company, New York, N. Y. Other books by Mr. Hinman include Pressworking of Metals and Practical Designs for Drilling and Milling Tools. He is also the author of the current series of monthly articles on Jigs and Fixtures in this magazine.

This book combines the basic mechanical principles of assembled die designs with their operating details, gives the necessary mathematical formulas for laying out the assembled dies and emphasizes a clearly rendered drafting technique. About four hundred drawings and photographs are given. These represent most of the key designs used in presswork.

Important sections of the book include: Sheet metal economy in the pressroom, a reprint of an original article appearing in the Tool and Die Journal; Blanking dies; Progressive dies; Bending and forming dies; "Cut-and-carry" progressive dies; Perforating and piercing dies; Feeding methods; Drawing shells; Calculating blank sizes; Fabricating aircraft parts; Hydrostatic dies; Forging, coining, swaging and extruding; Welding; Pressroom equipment and material. There are also a large number of excellent Tables for ready reference. A complete index helps make this new publication one of the most complete in its field. Mr. Hinman is to be congratulated on a job well done at a time when such a book is needed most.

"THE METALLURGY OF DEEP DRAWING AND PRESSING"—a comprehensive treatment of the subject by the distinguished British engineer, J. Dudley Jevons, now appears in second edition form only six months after first publication. As chief metallurgist in a group of works producing, among other things, pressings on an enormous scale, it is Dr. Jevons' duty to know as much about the production, properties and idiosyncrasies of sheet and strip metal as the manufacturers themselves and at the same time to know as much about the processes of pressing and drawing as the press-shop staffs. It is his business to be critical both of the material supplied and of the processing of that material in his works. For these reasons he is exceptionally well qualified to set forth the metallurgical knowledge underlying the processes of pressing and deep drawing.

Because the deep drawing and pressing industry has been the last branch of metalworking to avail itself of the help scientific knowledge can give, and because that scientific knowledge must be applied energetically to the craft of deep drawing and pressing if this industry is to keep pace with the rapid progress which is being made in other industries, this book will be welcomed by engineers and others concerned with the advancement of this important industry. Well illustrated, carefully written, the book sells for $10.00. It may be obtained from John Wiley & Sons, Inc., 440 Fourth Ave., New York, N. Y.

BELIEVING THAT TOOL CONSERVATION BEGINS IN THE TOOL CRIB—the Greenfield Tap and Die Corp. has issued a valuable booklet of suggestions on practical tool crib

(Continued on Page 176)

Here's a new quality line of
STANDARD AND SPECIAL TOOLS

For an additional, dependable source of quality cutting tools write for this new Arnold Tool Company catalog today. It's just off the press and contains the complete Arnold line of standard tools plus information concerning Arnold's ability to design special tools to your specifications. Over thirty years of precision toolmaking experience assures you of a quality product and deliveries are surprisingly fast. Write at once for this 40 page catalog. No obligation.

ARNOLD
Tool Company
14469 EUCLID AVE.
EAST CLEVELAND 12, OHIO

(Continued from Page 169)

arrangements. The bulletin reprints a series of Greenfield advertisements featuring solutions to tool crib problems and showing opportunities for tool conservation. Additional suggestions and general considerations about the location and layout of the crib are given. Besides such physical details as "making the most of your space", the "tool crib window" and "types of bins", the booklet covers identification of tools in the bins and a tool crib accounting system. The suggestions have proved valuable in many companies throughout the country and are urgently recommended to plant managers, superintendents and foremen. Copies are available free upon request to the Greenfield Tap and Die Corp., Dept. T-D, Greenfield, Mass. **108-B**

A HANDY WALL CHART—put out by Melin Mills tells at a glance how to overcome such persistent milling production "bugs" as overheating, breakage, chatter and slippage. The chart has been printed to show the consumer how to get longer life at high speeds with Melin long-life, high-speed end mills. It contains a speed table, the use of which is advised for better results.

During these days when expensive tools are entrusted to inexperienced operators, the posting of the chart should be of great value to every plant using end mills. For copies, write on company letterhead to Melin Mills, 2228 Bellevue Ave., Detroit 7, Mich. **109-B**

THE ADVANTAGES OF HAND STONING CUTTING TOOLS—are outlined in a new booklet published by Behr-Manning and entitled "Hand Stoned Cutting Tools for Faster, Better, More Cuts." Hand stoning, after grinding, it claims, produces sharper tools than is possible with grinding operations only, keeps tools sharper for longer periods, increases time between grinds and reduces waste of metal and setting-up time. It cites reports from nationally known users of increases in production from oil-stoned tools and pictures the most popular shapes from among the many varieties available in both electric-furnace and natural minerals. The story the booklet tells should be of interest to any shop man or executive concerned with achieving effective cutting operations. Copies are available free on request to the Behr-Manning Co., Dept. W, Troy, N. Y. **110-B**

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Brightboy
For "ALL-IN-ONE" FINISHING, DE-BURRING, POLISHING
● Bridges the gap between a grind and a buff.
● Does not load, gum or fill.
● Works metals with minimum dimensional loss.
● Requires no special preparation.
● Gives a precision finish that frequently serves as a final polish.
● Made in wheels, blocks, sticks, rods,—for manual and machine operations.
Write us if your dealer cannot furnish you with Methods and Applications Data, samples and prices. Our field representatives are at your service.
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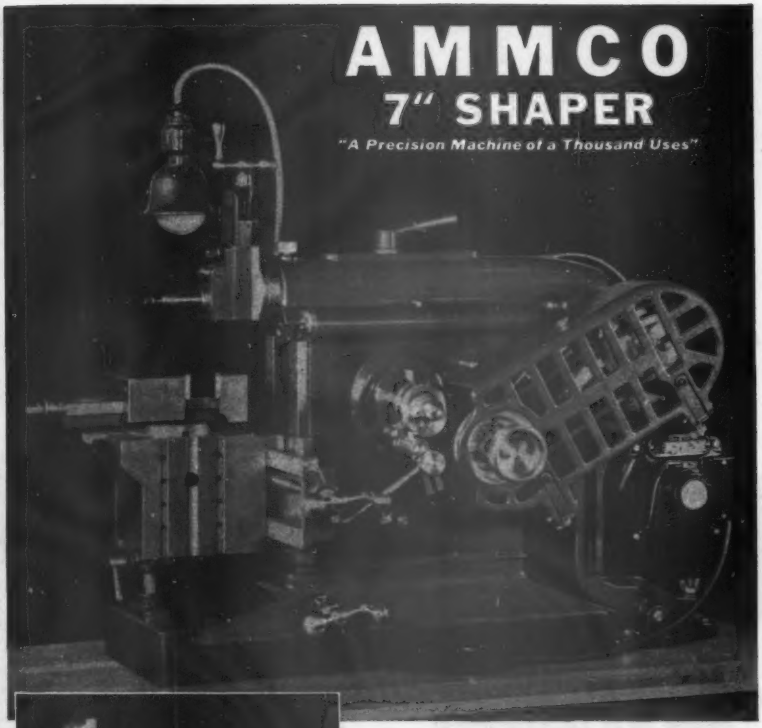
WELDON ROBERTS RUBBER CO.
Newark, N. J.

ELECTRONIC CONTROL OF RESISTANCE WELDING—by George M. Chute is a practical manual that explains the tubes and circuits used to control resistance welders. It builds up a complete practical picture of electronic controls, step by step from the ignition contactor up to circuits combining

(Cont'd on Page 172)

AMMCO
7" SHAPER
"A Precision Machine of a Thousand Uses"



On jobs requiring a stroke of 7" or less, the AMMCO 7" PRECISION SHAPER will enable you to save a lot of time and expense in a set-up which would be required for larger shapers. Furthermore, the AMMCO will enable you to get away from the cost of operating a big shaper on small work.

Portable Cabinet model enables this shaper to be moved about the shop.

•

IT'S PORTABLE

- **Saves time and steps!**
- **Can be moved from job to job in tool and die shop!**
- **Just wheel up to bench--plug in--and go to work!**

Write today for specifications and prices

ARMY E NAVY

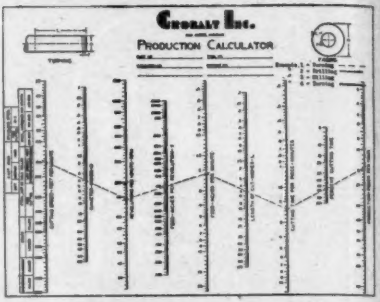
AUTOMOTIVE MAINTENANCE MACHINERY CO.
2100 Commonwealth Ave.—North Chicago, Illinois, U. S. A.

(Continued from Page 176)

spot, pulsation and seam welding in one device, and stored-energy controls. How the tubes work, power requirements, the factors of good welding involved, installation and maintenance of the devices—all are covered to give the reader the ability to get the most in long life and efficient service from this equipment.

The book is simply and clearly written—it aims at getting the practical know-how across to men of limited technical training. There are 389 pages, 173 illustrations. Price $4.00 from McGraw-Hill Book Co., Inc., 330 W. 42nd St., New York, N. Y.

AN INGENIOUS CHART THAT SIMPLIFIES CALCULATIONS FOR MACHINING OPERATIONS—has been designed by C. L. Bendle, vice president of Crobalt, Inc., in charge of Sales Engineering. The chart has a wide range of diameters, rpm's, etc., which cover the average types of machining operations.

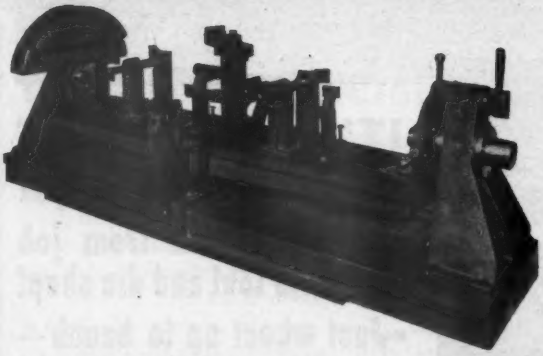


It enables the estimator to predict more accurately the production in pieces per hour. It may also be used by the engineering department to arrive at the greatest production or for the visual analysis of an operation that is not being run as efficiently as desired, as it will usually indicate where inefficiency of a tool set-up exists. The chart can also serve as a permanent record of the cutting conditions of a job.

The charts are assembled in a pad, so that after a specific problem has been solved, the page may be torn out and filed with blueprints or specifications, or sent to the shop to help in set-up and production. Free copies of this Production Calculator may be obtained by writing Crobalt, Inc., Dept. F, 1354 N. Main St., Ann Arbor, Mich. **107-B**

JUST OUT—is Wheelco Instruments' five new bulletins describing its complete line of industrial indicating, recording and control thermometers.

We Sell Precision . .



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Hardened and Ground Parts to Order.

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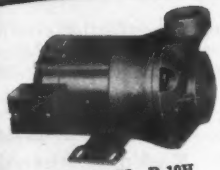
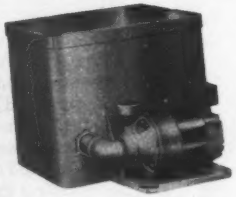
Penrod Centrifugal Coolant Pumps



MODEL P-10H



MODEL P-10H PUMPS ARE EASILY APPLIED
PENROD PUMPS GIVE BETTER SERVICE

Model P-10H pumps use the motor feet for mounting and can be located in any position as long as the liquid will flow into the pump by gravity. This pump is easily installed on old or new machines and is ample enough to handle single or multiple installations. Model P-10H-⅛ will pump up to 1200 G. P. H. and Model P-10H-¼ up to 2400 G. P. H. Penrod pumps are conventional in style but we have incorporated many new features such as replaceable seal assemblies, totally enclosed motors, grease sealed ball bearings, streamlined design, etc.

Tank built especially for Model P-10-⅛ Pump can be supplied promptly. Made from heavy sheet steel and containing built in baffle to collect chips. Lid can be removed to clean tank without disconnecting return pipe fittings.

Model P-10H pumps are ready for immediate delivery. Phone or wire us for details.

FLOYD PENROD & SONS
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1208 - 1216 W. 2nd Street Muncie, Indiana

SPECIAL OR STANDARD GAGES OF ALL TYPES

These special segment thread gages are examples of the wide variety of thread, plug, and ring gages being regularly produced in our plant. Designed by our staff of engineers and manufactured to specified tolerances, they represent the highest skill and craftsmanship. The same high standards apply to special tools, fixtures, machines and parts, produced singly or in volume on contract. Our facilities and equipment are equal to the finest in the country. Write for literature describing these special engineering and manufacturing services, and our line of standard gages, carried in stock for prompt shipment.

MERZ *Engineering Company*
INDIANAPOLIS 7, INDIANA

(Continued from Page 126)

portant foreign power, the first of several plants purchased to speed war production. Visitors saw rod processing from start to finish. Beginning with the weighing and mixing of flux, straightening and cutting the wire, through to final inspection and packing, every step in rod production was examined by onlookers. Moslo experts were there to explain technical points in the plant's operation.

Complete runs were made every day during the show, and before the end of the ten days, attendance reached a point where it was necessary to make runs both morning and afternoon.

Foremen Hold Radio Convention

The first national convention ever held by radio will be staged by the National Association of Foremen in September over a nationwide network, it was announced by Frank H. Irelan, vice president of the N.A.F.

Desire to aid in the war effort by eliminating the convention's normal demand for transportation and hotel accommodations for several thousand men, and by enabling the association's members to remain on their jobs in war production inspired the novel plan.

Throughout the country, member clubs of the association will hold local meetings at which they will listen to the national broadcast and then proceed with localized discussions by association members and by other industrial leaders.

Brady-Penrod, Inc., Muncie, Ind., manufacturers of coolant and circulatory pumps for machine tool use, has opened a branch office and factory at 1945 Santa Fe Ave., Los Angeles, Calif., in order to better serve the West Coast and Pacific trade.

(Cont'd. on Page 182)

C-F POSITIONERS

Cut Welding Time
Reduce Welding Cost
Improve Welding Quality

All sides, top and bottom, are welded downhand with one set-up. No waiting for the crane, no "handling" crew needed, for the welder himself rotates (360°) and tilts weldment (to 135° beyond horizontal) with a push button control. This "all-down", hand welding method permits use of larger rods, hence requires fewer passes and gives stronger, smoother, more uniformly flawless seams and joints.

C-F Positioners, pedestal mounted and adjustable for height, come in 6 capacities—from 1200 lbs. to 30,000 lbs. Manual, motorized or motorized variable speed operation.

Write for Bulletin WP-22

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FROM STOCK
On Standard Sizes

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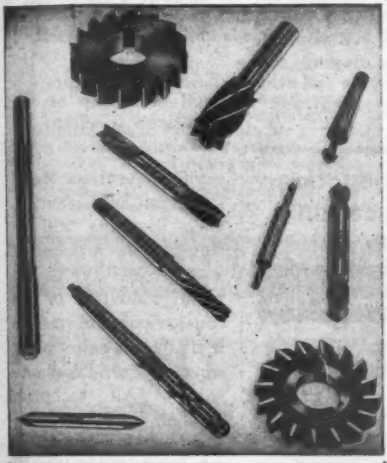

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Side and Face Milling Cutters
Stagger Tooth Side Milling Cutters
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Write for prices on standard sizes or submit blueprints for quotations on special sizes.

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FIVE SIZES
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ACCURATE
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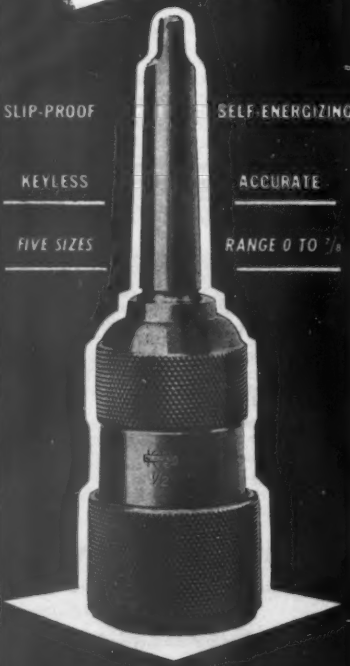


Write for bulletin DC. 42-TD

KNOCK-OUT

K. O. LEE CO.
ABERDEEN, S. DAK.

INDUSTRIAL DIGEST

(Continued from Page 180)

Brady-Penrod Opens New Office

The newly established Los Angeles factory is fully equipped with machine facilities for the manufacture of the Brady-Penrod line. Sales and delivery to west coast industrial concerns will be facilitated by the Los Angeles office.

L. D. Ashe, long identified with the pump business in a managerial capacity, has been appointed general manager of the branch, and C. R. Hall has been made sales manager.

Metal Congress Set For Chicago

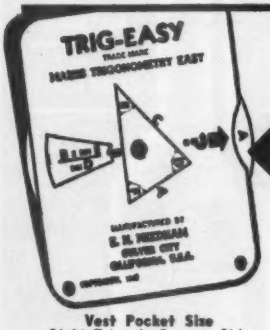
A War Conference Display will be one of the outstanding features of the 25th annual National Metal Congress, planned for the week of October 18 in Chicago, according to W. H. Eisenman, managing director of the meeting and national secretary of the American Society for Metals.

"The entire Metal Congress and Conference Displays will be tuned to the increase of war production in the metal industry, to the conservation of metals and to postwar planning," Mr. Eisenman said. "All technical sessions will be streamlined and comprehensive in their contributions to the war problems and will contribute decisively and materially to the shortening of the war."

Production problems involving shortages of many strategic metals, more efficient use of equipment, and continued training of personnel will be dealt with at sessions of the Congress.

Four big national societies will again cooperate in the Congress. In addition to the

(Cont'd. on Page 184)



Vest Pocket Size
Right Triangle Reverse Side

Speed Production Thru Education of Personnel

This Amazing Chart Makes Trigonometry Easy

40 equations quickly found. Eliminates errors. Determines angles & dimensions, without knowledge of higher math.

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BREAK TIME-WASTING BOTTLENECKS with the TRIG-EASY CHART, for every man whose work requires solution of problems involving angles. Saves his own time and time of those who must wait for calculations.

Correct equation is always instantly found with TRIG-EASY. 18,000 in use today. Pays for itself every time used. You can speed production thru education of personnel. Send for TRIG-EASY today, and only 50c with complete instructions. MONEY-BACK GUARANTEE.

TRIG-EASY
E. H. NEEDHAM
DEPT. 1-N. CULVER CITY, CALIF.
QUANTITY DISCOUNT TO INDUSTRIAL FIRMS

In War, as in Peace...

CERRO ALLOYS

SAVE TIME and CUT COSTS!

CERROMATRIX (Melting Temp. 250° F.) For securing punch and die parts, anchoring machine parts without expensive drive fits, short run forming dies and other metal-working applications.

CERROBEND (Melting Temp. 158° F.) Used as a filler in bending thin-walled tubing to small radii. Easily removed in boiling water. Also used for aircraft assembly jigs, templates for forming dies and other purposes.

CERROSAFE (Melting Temp. 190° F.) Used to accurately proof-cast cavities such as molds, gun chambers, forging dies, etc. and for many similar applications.

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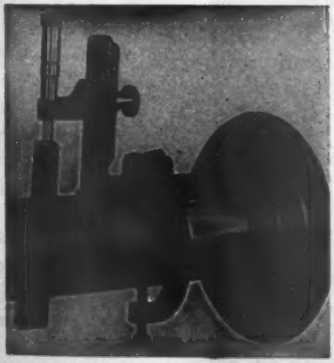
40 WALL STREET - - - - NEW YORK, N. Y.

BARTELT PEDESTAL MICROMETERS

formerly called Bartelt Tool Setting Gages

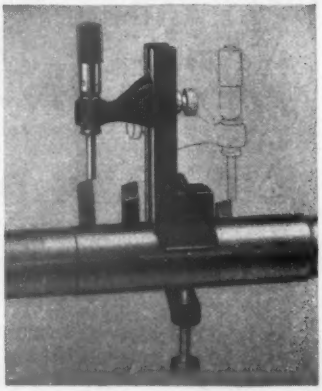
★ These handy, practical gages will speed up boring work and help to produce accurate results more easily. Inexperienced hands are aided toward becoming good workmen more quickly. Available in two models, as shown. Three clamps furnished, to fit all boring bars from 1″ to 5″ diameter.



MODEL "A" ←

MODEL "B" →

Write for Circulars



BARTELT
ENGINEERING COMPANY
1212 PARTRIDGE AVE.
BELOIT • WIS.

(Continued from Page 182)

American Society for Metals, there will be the American Welding Society, the Wire Association and the Iron and Steel and Metals divisions of the American Institute of Mining and Metallurgical Engineers.

War Conference Displays and A.S.M.E. displays will be concentrated in the Palmer House, with the American Welding Society at the Morrison Hotel, the Wire Association at the LaSalle, and the A.I.M.E. at the Sherman.

It is estimated that from 50 to 70% of all the metallizing guns in use today are being operated at uneconomically slow speeds. Modern metallizing equipment is designed to operate at high speed, and unnecessary reduction of this speed is definitely disadvantageous, for several reasons.

Slow Speeds in Metallizing Uneconomical

When wire is fed through the flame too slowly, atomization becomes finer, and the percentage of oxide in the coating increases. Microphotographs show an oxide film around each particle in the coating. Therefore, if the average diameter of the sprayed particles is reduced to one-half normal through slow wire feed, the total surface area, and hence the total oxide, is multiplied by four. There is also an additional oxide increase due to greater superheat, and longer exposure to the flame.

Deposit Efficiency

The vaporization of the common metals in the intense heat of an oxy-acetylene flame is of small consequence when the wire is fed at proper speed, but it may cause a loss in deposit efficiency if the wire is fed too slowly. Many of the extremely fine components of the spray are not deposited on the work, but are

(Cont'd. on Page 186)

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and Greater
FLEXIBILITY
with
CULLMAN DRIVES
Machine tools, now shaft driven, can be modernized with Cullman Drives for individual control to give increased production of more than 25%.
Cullman Drives can be installed in from two to four hours. Only four bolts are required. Cullman Drives are available for motors from ¼ to 15 H.P. Prompt deliveries can be made on most sizes.
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for *Precision* Usage

Smith Master Surface and Lapping Plates have become the standard for precision accuracy in aircraft and ordnance plants all over the country. Gauge makers who demand a superior surface plate and precision accuracy are standardizing on Smiths.

For sizes, prices, and delivery, wire, phone or write.

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EFFICIENCY
for the
PRODUCTION BATTLEFRONT

Speed Up Victory with "Oliver"

The tool behind the tool that does the job will help to speed up your production. 100% efficiency can be obtained only with tools that are well sharpened and kept in perfect condition. Speed up production by faster sawing and filing operations with Oliver Die Making Machines. They save 50% to 60% of the labor over hand methods in the cost of making precision Dies, Gages, Cams, Templates and similar products requiring rapid and accurate sawing, filing and lapping operations. It will pay you to investigate the line of Oliver Die Making Machines!

Send for descriptive literature today!

OLIVER INSTRUMENT COMPANY
1436 Maumee St., E. -:- Adrian, Mich.

(Continued from Page 184)

carried away by the blast from the gun, and metallic vapors which recondense in the air blast are not likely to be deposited on the work.

Machinability

The hardness and brittleness of coatings containing excessive oxides make them very difficult to machine. The hard rings, consisting very largely of oxides, which form adjacent to the shoulder of the undercut section, are thicker when the spraying speed is low. The tensile strength is also lowered and the danger of cracking increased.

Oil Absorption

A large part of the excellent wear resistance of sprayed metal is due to its ability to absorb oil and to maintain an oil film. Extremely fine coatings, the pores of which are largely filled with oxide, however, will not absorb as much oil as a normal coating, thus reducing wear resistance.

Economy

Too slow spraying speeds, particularly with low melting point metals, can cause fusing of the wire at the end of the wire nozzle. This results in frequent nozzle replacement. Also, gas, oxygen, air and labor costs go up considerably, and additional wire is used in order to compensate for loss in deposit resistance.

How to Secure and Maintain Maximum Spraying Speeds

After setting regulators at desired pressures, it is best to slowly increase the speed of the wire until the gun is spattering rather than atomizing. Slowly raise and lower the oxygen pressure while watching the melting end of the wire. Attempt, by changing

(Cont'd. on Page 188)

DOUGLAS PRECISION SLOTTER
Swiveling ram head and tool holder, automatic circular table and independent automatic feeds in all directions.
7" TO 10" STROKE
PROMPT DELIVERY
DOUGLAS MACHINERY CO. INC.
150 BROADWAY
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"TIME SAVER"

Improved holder with interchangeable steel type makes part number changes a simple operation. Turn a screw to make the change. . . .Guaranteed for years of service. Used by hand or press, it's a time and money saver.

STOCK SIZES:

TYPE #1

TYPE #2

TYPE #3

PROMPT DELIVERIES

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TWO MACHINES IN ONE!

For Die-Filing Use Top Table in Position Shown.

For Punch or Blind-Hole Filing Tilt Top Table Back, Use Lower Table.

DIE TABLE Filing From Below

PUNCH TABLE Filing From Above

No more hand filing of intricate jobs or inaccessible parts! With this Duplex Die and Punch Filing machine you can take care of all filing and lapping jobs as they come along. Stroke fully adjustable from 0 to 1½". Two Speeds. Fully enclosed motor. Ball Bearings throughout. No dripping of oil. No waste of unused file sections.

Write for Descriptive Circular.

★

IDEAL MACHINE TOOL COMPANY - 735 CONGRESS STREET SCHENECTADY, N. Y.

(Continued from Page 186)

pressure, to secure good atomization which will result in the wire melting back closer to the end of the air cap. If after adjusting the oxygen the wire is still spattering, slow the wire feed only to the point where spattering ceases. On the other hand, if the oxygen adjustment results in the wire melting back level with, or close to the end of the air cap, the wire feed should be speeded up to the spattering point and then slightly retarded as before.

The melting end of the wire should always project beyond the end of the brass air cap as far as possible. It should never be level with or inside the end of the air cap.

If small blue streamers of flame appear while spraying, acetylene pressure has become too high. Oxygen pressure should then be raised slowly until the blue streamers disappear. If the flame becomes smaller, and the wire appears to speed up and run out of the flame, oxygen pressure is too high and should be lowered slowly until atomization is again normal.

This is a digest of an article in the May-June issue of Metco News, published by Metallizing Engineering Co.

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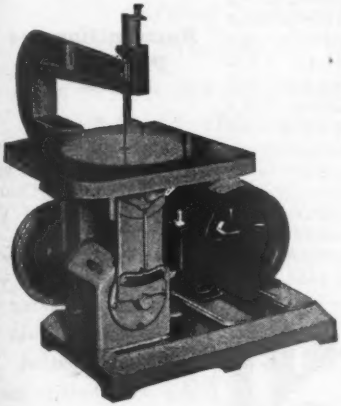
PUMPS...
DEPENDABLE...
DURABLE
MODEL CE
Immersion Type
● One of a complete line of pumps for all machining operations. ● Built for twenty-four hours a day service. ● Instantaneous coolant delivery, self-priming, never becomes airbound. ● Does not build up pressure at slow speeds. ● Unharmed by abrasives in liquid—or by running dry. ● Built by one of the country's largest pump manufacturers.
Write or wire for literature, prices and deliveries.
GILBERT & BARKER MFG. CO.
WEST SPRINGFIELD, MASS.

Pioneers in an intensive application of the policy of employing women for production of precision cutting tools, Archer & Smith, Ltd. (formerly Hub Tool Co.), Lexington, Ky., now report that they are more than satisfied with this type of specially trained tool makers. Under the direction of skilled men, practically all the operating employees are women, all of whom have taken an intensive training course at the plant, under actual production conditions. Production men, superintendents, foremen, setup men and others working with the women are carefully selected for their skill and experience.

Women Excel in Precision Toolmaking

(Cont'd. on Page 190)

IMMEDIATE DELIVERY!



ATLAS DIE FILING MACHINES

Can be used for all kinds of die making. The overarm is constructed so that the file and saw attachments may be interchanged with little effort. The hold-down fingers are attached directly to the overarm. Working surface of the table, which tilts two directions, is entirely clear. An improved type of chuck, consisting of movable hardened jaws, holds both saws and files. Screw adjustment makes changes easy and fast.

COMPLETE WITH MOTOR—$125 NET
F.O.B. CHICAGO

Detroit Distributor:
International Machinery Co.
3131 E. Jefferson Ave.

ATLAS EQUIPMENT COMPANY
101 S. CLINTON ST., CHICAGO, ILL.

PRK-33 COBALTCROM *for long* PRODUCTION RUNS . . .

Air Hardening, Non-Deforming, Cobalt High Carbon, High Chromium Steel.

PRK-33 Cobaltcrom is the outstanding achievement in the development of a quality tool and die steel for long production runs.

Grinds super-keen, unsurpassed for dies requiring a perfect edge for eliminating flash, high polish and minimum deformation.

PRK-33 Cobaltcrom casts into intricate shapes to eliminate 80% of machining.

Bar Stock and Billets in stock. Drill Rods and Tool Bits on order.

DARWIN & MILNER, Inc.
1260 West 4th Street
Cleveland 13, Ohio
Tel. Main 9655
Specialists in Alloy Tool Steels

INDUSTRIAL DIGEST

(Continued from Page 188)

Aided by modern equipment which reduces physical effort by the operator to a minimum and permits closest control of all precision operations, these skill-trained women tool maker-ettes at Archer & Smith, Ltd., have proved highly successful. Precision standards have been consistently maintained, volume has been thoroughly satisfactory, absenteeism has not been a problem, and the "all women" policy is solving a manpower problem in a very practical manner.

The roster of companies receiving the coveted Army-Navy "E" award admitted the names of "Skilsaw", Reed-Prentice and Chambersburg Engineering within the past few weeks. In making the award at Chambersburg, Colonel Thomas G. Lanpher recalled that just 80 years ago troops were marching through Chambersburg on their way to one of the bloodiest and most decisive battles of the Civil War—the Battle of Gettysburg. He paid tribute to the contribution the company is making in the production field to make the battles of this war decisive ones.

Recognition for Production

The White Star was added to the "E" flag already possessed by Reed-Prentice Corp. for an earlier record of excellence in war production. Robert F. Patterson, Under Secretary of War, termed the White Star "a symbol of appreciation from our Armed Forces for your continued and determined effort and patriotism."

General Charles Keller presented the "E" flag to Skilsaw in an impressive ceremony at the company's Chicago plant. Bolton Sullivan, president, accepted it on behalf of his employees.

TYPE 10 and 14 FEATURE THE *NEW* PATENTED
NO SPRAY NO SPLASH WHEEL GUARDS
"You're Dry when you grind Wet"
Guards are concealed, easily accessible, maximum light and operation freedom around the wheels.
WRITE FOR BULLETIN 201
Other Hammond Grinders: "4" Combination Chipbreaker and Grinder; 6, 10A, and 20S Carbide Tool Grinders.
Hammond OF KALAMAZOO
CARBIDE TOOL GRINDERS
MODELS 4, 6, 10, 14, 20

MODEL 14W "WET"
Hammond Machinery Builders INC
KALAMAZOO • MICHIGAN
Eastern Branch
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New York 10, N. Y.
1631 DOUGLAS AVENUE

The Knurled Heads Save Time

because fingers can turn the "Unbrako" without slipping and lost motion. Where many socket cap screws are used in production, this saves much time.

UNBRAKO ★

SOCKET HEAD CAP SCREWS

★ Reg. U. S. Pat. Office

Sizes: No. 4 to 1½" diameter. Get the "Unbrako" Catalog for details.

STANDARD PRESSED STEEL CO.

JENKINTOWN, PENNA. BOX 101

— BRANCHES —

BOSTON • DETROIT • INDIANAPOLIS • CHICAGO • ST. LOUIS • SAN FRANCISCO

OVER 40 YEARS IN BUSINESS

Knurling of Socket Screws originated with "Unbrako" years ago.

for SPRINGS

made to precision standards for instruments, dies and tools—specify GIBSON, product of 65 years specialized experience. Scientifically designed for the work they are to do, made to exact specifications, heat treated and thoroughly tested, they function more accurately, last longer, save time in assembly and adjustment, reduce spoilage, cut costs all around. Investigate! Write us about your requirements.

THE WILLIAM D. GIBSON CO.—CHICAGO

1800 Clybourn Ave. Phone, MOHawk 6622

(DIVISION OF ASSOCIATED SPRING CORPORATION)

New Process Securely Bonds Plating Metals

A NEW process by which plastics, glass, or any non-conductor, is perfectly plated with any of the plating metals, is announced by Precision Paper Tube Company.

Plating of plastics in the countless range to which this great improvement is applicable is now in progress in Precision's complete setup for this work.

By Precision's new process the plating goes on the plastics as perfectly and as permanently as the best in any plated metal. Convex and concave surfaces, convolutions, corners and recesses are as thoroughly plated as flat or simple round surfaces. The metal plating is permanent. It does not crack, chip, nor peel off in long and severe service.

The advantages are many. Critical and strategic metals are conserved. Production costs are greatly reduced. Weight is saved. Design can be much simplified. Dimensional stability is insured. Oils, solvents and moisture cannot be absorbed. Electrolytic corrosion between dissimilar metals is eliminated. Heat resistance is increased.

Precision's new process can be used for plating magnetic and electric shielding of all kinds—radio shielding, electrostatic and magnetic shielding, applications as coil shields, condensers, etc. Thousands of plastic articles can be made more permanent, more beautiful. Plastic articles can be had to match any of those made of metals. Conductor and insulator can be combined in one unit.

Both rigid and pliable types of plastic tubing and pipe fittings can be plated. The uses of the process extend into all electrical and mechanical manufacture.

Precision engineers will be glad to counsel with manufacturers on applications of this new process to their products. An invitation is extended to write for detailed information and estimates.

Precision Paper Tube Co., Special Prod. Div., 2021 W. Charleston St., Chicago 47, Ill. 50-B

***NOW*... THE NEW**

GLASS

SURFACE PLATE

AFFORDS YOU THESE ADVANTAGES:

1 - Accuracy .0002, .0003, .0004, .0005.

2 - Checked carefully with optical instrument.

3 - Hard surface. Wear shown as scratches. These do not affect accuracy unless grouped densely. Scratches do not burr.

4 - Low co-efficient of expansion Fahrenheit. 4.45 x 10^{-6}. Temperature changes have little effect.

5 - Requires no de-magnetizing.

6 - Non-rusting. Requires no oiling.

7 - Transparent. Data or formulae may be placed under the flat for ready reference.

8 - Easy to check. Optical instruments for checking purposes available in most large centers.

9 - Replaces critical material.

COST of Cadillac Glass Surface Plates is low — probably less than resurfacing a scraped steel plate. Long lived — Prompt delivery. Packed in individual wood boxes, top of which forms a protecting cover.

PRICES, from $11 to $90, dependent upon size and degree of accuracy wanted.

CADILLAC GLASS CO.

900 WEST CERMAK ROAD CHICAGO, ILLINOIS

A detailed discussion of the impregnating capacity of colloidal graphite dispersions and the application and results of impregnation and surface coating of colloidal graphite is given in a new Acheson Colloids Corp. bulletin. **129-B**

ARMY
E
NAVY
"E" TO UNIVERSAL FOR OUTSTANDING ACHIEVEMENT IN THE MANUFACTURE OF VITAL TOOLS
We are proud to announce that we have been awarded the coveted Army-Navy "E" in recognition of the quality and quantity of the Universal precision parts we have been producing for the war effort. We are also glad to announce our new Universal Mikrolok, the boring bar which can be quickly adjusted like a micrometer to limits of .0005 or less. Write for catalog.
UNIVERSAL ENGINEERING CO.

Adjustable Milling Spacer

A BIG bomber or tank is just an assembly of thousands of small parts, but each is vitally important in itself.

The Rousselle Adjustable Spacer is a little thing—but by saving time for your milling machine set-up men it can do its part in saving hours and hours of production time every month.

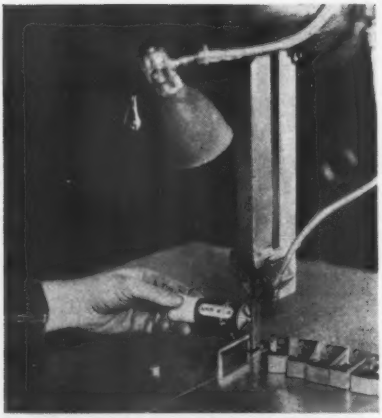
It slips onto the arbor between conventional spacers. A twirl of the wrist expands the Rousselle to the required setting, and the inner ring locks it securely. Thus tedious and time-eating spacer grinding is eliminated. Plain .001" graduations make accurate re-setting easy.

Rousselle Spacers fit all standard arbor diameters from ¾-inch to 4-inch bore. Precision to .001" is guaranteed.

Write for Bulletin TD-83 and prices.

PROMPT DELIVERY—Priority Certification Must Accompany Orders. Dealers: Write for Dealership Plan.

DAVID J. ROSS CO.
BENTON HARBOR, MICH.



New Lubricant for Sawing of Metal Developed

COMPOUNDED to withstand extreme pressures, minimize scoring and heating of the saw and to produce a smoother cut, Doall Saw Eez is now available to all saw users.

Scoring of the back of the saw has long been a problem for the saw user. Recently the following test was made with a ½", 14-pitch saw on oil hardening tool steel: Four 10-foot lengths of saw were cut from a 100-foot coil and numbered "1", "2", "3", and "4". The oil hardening tool steel was cut into five blocks. These same five blocks were used for all four saws and the blocks were alternated every cut to eliminate any possible errors which may be due to the lack of homogeneity of the steel.

Saws "1" and "2" were tested on straight cuts. On "1", the unlubricated saw, a light scratch of scoring was noticed after cutting 20 sq. in. of material, and the scoring progressed at a normal rate throughout the balance of this test.

Saw "2", lubricated with Eez, cut 188 sq. in. of material before any signs of scoring appeared.

Saws "3" and "4" were used for contour sawing. Saw "3", unlubricated, showed signs of light scoring after a cut of 20 sq. in. and was heavily scored when 28 square inches had been cut. Saw "4", lubricated, developed a light scratch after sawing 16 sq. in. but no scoring appeared even after 152 sq. in. had been cut.

The Doall Co., Dept. TD, Des Plaines, Ill. 130-B

Use Them Over and Over

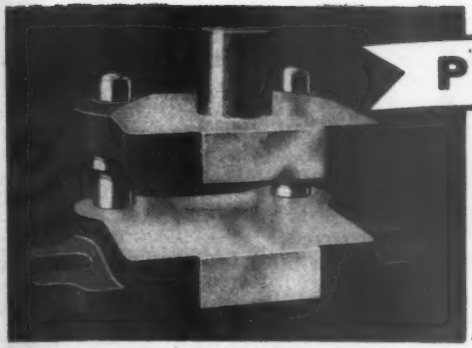
DE-STA-CO ARBOR SPACERS

Measured by the number of times they can be used, De-Sta-Co Spacers are the lowest in cost of any spacers you can buy. Made of metal, they are not affected by oil or heat. Use these spacers for quick set-up of milling machine cutters and wherever low cost, accurate spacing is required.

Stock sizes .001" to .125" thick. Specials, any length, cut from bar stock, ground to decimal.

TRIAL ASSORTMENT—enough for average use on one machine sent for $1.00. Give arbor size. *Size and price list sent FREE!*

DETROIT STAMPING CO.
Established Over 25 Years
344 Midland Ave • Detroit, Mich.



PRODUCTO DIE SETS

PRODUCTO

PRODUCTO Die Sets are available for shipment from our factories in Bridgeport, Connecticut, and Detroit, Michigan; also Die Supply Company, 4747 Hough Avenue, Cleveland, Ohio. Pacific Coast users now obtain quick service from Jamison Steel Corporation, 2168 East Olympic Boulevard, Los Angeles, California, and 508 Fourth Street, San Francisco, California.

Die Makers' Accessories . . Dowel Pins, Socket Screws, Stripper Bolts, Die Springs . . in stock at above points.

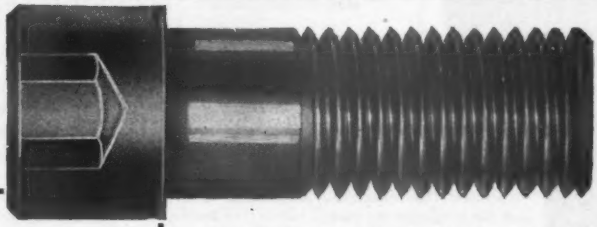
War plants needing above items can depend on best possible service from Producto.

Use Producto Modern Machine Vises—Ask for circulars.

THE PRODUCTO MACHINE COMPANY

BRIDGEPORT, CONNECTICUT

3019 Medbury - - - - - - Detroit, Michigan



STRONG ACCURATE

SAFETY "BLUE-DEVIL" CAP SCREWS

- Sturdy Cold-Formed Head with Unimpared Continuity of Fibres
- Precision-Formed Hexagon Socket with True Sides and No Taper
- Increased Solid Metal Section at Union of Head and Body
- Threads Die Cut — Accurate Class 3 FR

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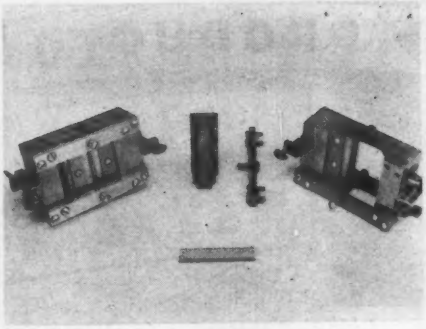


Baldwin Develops Jig for Determining Compression Yield Strength

A NEW jig for the determination of compression yield strength in aircraft design has been developed by W. P. Montgomery and R. L. Templin and is now being offered by The Baldwin Locomotive Works, Philadelphia, Pa.

It has been the custom to obtain values for compression yield in sheet metal by testing the sheets in packs. The sheets would be piled up to a thickness equal to the width of this test sheet and the pack would then be supported by needle points held in a special fixture.

With the new method developed by Montgomery and Templin, it is possible to test a single thickness of sheet in compression supporting the sheet in the jig as shown in the photograph with a multiplicity of small rollers. The extensometers are attached to the edges of the sheet.

The testing of the material in single sheet form requires a smaller load and simplifies the technique of testing to a large extent. The Montgomery - Templin jig—simple and inexpensive—reduces the apparatus to its lowest terms.

For further information, address The Baldwin Locomotive Works, Dept. K, Philadelphia, Pa. 131-B

TWO WEEKS' DELIVERY

Johnson Furnaces

· No. 130A Hi-Speed Steel Heat-Treating Furnace

4 Burner (Shown) $295.00

6 Burner Unit $325.00

All Prices F. O. B. Factory

Notice the counter balanced door which opens upward, allowing tools to be put in or removed without fully opening the furnace door — thus avoiding temperature drops. Carbofrax hearth and ¼ H.P. motor are standard equipment. Lined with hi-temperature insulating refractory. 4-burner job has temperature range from 1400 to 2000°, while 6 burner unit offers 1800 to 2400°. Firebox is 7¾" high, 13" wide, 16½" long.

JOHNSON GAS APPLIANCE CO.
532 E Ave., N.W., Cedar Rapids, Iowa

Free NEW JOHNSON CATALOG
WRITE ADDRESS ABOVE

American Society of Industrial Engineers Academy Award, presented to Thomas F. Saffady of Sav-Way Industries, June 30, was made in recognition of his outstanding contribution to the progress of industrial engineering and the war through the firm's record output.

"E" TO UNIVERSAL FOR OUTSTANDING ACHIEVEMENT IN THE MANUFACTURE OF VITAL TOOLS

We are proud to announce that we have been awarded the coveted Army-Navy "E" in recognition of the quality and quantity of the Universal precision parts we have been producing for the war effort.
You can improve your jig operations with Universal Drill Bushings. They are straight and round and have super-finished bores for accuracy and long life. Write for complete catalog.

UNIVERSAL ENGINEERING CO.
FRANKENMUTH · MICHIGAN

"It's the Biggest Little Tool in the Crib"

Walton TAP EXTRACTORS Back Out Broken Taps

WALTONS cut costly delays and production slowups caused by broken taps. Your tool makers and machinists should have them available in necessary sizes. Many shops say they wouldn't be without them.

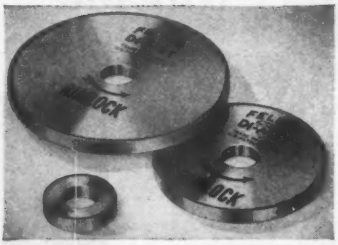
Immediate Shipment of all sizes against rated orders. 48 hour Reconditioning Service for your broken and damaged tap extractors.

Write for Folder No. 13.

The WALTON Company
94 ALLYN STREET · HARTFORD, CONN.

Felker Announces Thick Body Series

Di-Met Rimlock Diamond Abrasive Wheels



FOR precision cutting, milling, grooving and facing all types of hard, brittle materials such as glass, quartz, steatite, ceramics, porcelain, tile, vitreous materials, etc., the new thick body series of Di-Met Rimlocks has been developed by Felker Mfg. Co. The Di-Met Rimlocks differ from former types in their increased range of thickness, varying from 1/16" to 1/2". Any width wheel between these limits is available in diameters of 1" to 6". Standard arbor hole dimensions are 5/8", although other sizes can be furnished as specified.

The Di-Met Rimlock bond is a special process developed by Felker which rigidly anchors the crushed diamond particles in the periphery of the cutting wheel, obtaining longer wheel life, faster cutting and excellent surface finish on the work.

Adequate coolant of proper type must be used during cutting operations and should be selected for the material being cut. Surface speeds vary but are relatively high, averaging from 2000 to 4000 sfm. Recommended operating procedures on special applications will be advised by Felker, manufacturers of other Di-Met diamond-abrasive cutoff wheels and chipbreakers. The Di-Met Rimlocks are not suitable for cutting metal.

Complete details are available from Felker Mfg. Co., Dept. T-J, Torrance, Calif. 132-B

War Plane Specifications Require Torquing
Modern manufacturing methods call for controlled "settings" of vital nuts, screws, bolts, hydraulic fittings—of almost all threaded parts. Leading American aircraft and engine builders almost universally use the permanently accurate STURTEVANT TORQUE WRENCHES for innumerable applications ranging from building precision instruments to testing frictional drag in controls and motors. 50 models, capacities ranging from 0 to 5 in. pounds on up to 7200 in. pounds.
Write for catalog sheets.
Model F-100-I (Capacity 0-100 in. lbs.) Illustrated
P.A. STURTEVANT CO.
ADDISON QUALITY ILLINOIS

Grobet

ROTARY FILES

HAND CUT — MILLED CUT
GROUND FROM THE SOLID

There is a Grobet Rotary File, Cutter, Diesinker's Bur in shape, size, and coarseness of cut for every type of hard or soft metal, plastic, wood, etc.
Send for Catalog Y. R. illustrating the complete line in full size, speed charts, etc.

GROBET FILE CO. of AMERICA

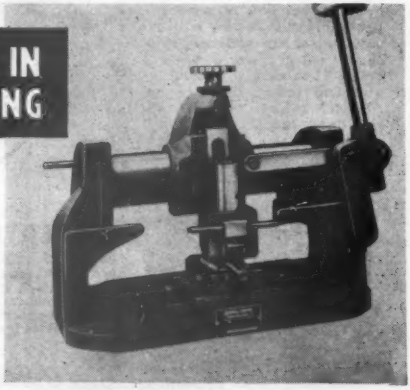
421 Canal Street — 1812 — 1943 — F. L. GROBET — **New York 13, N. Y.**

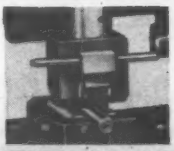
IMPORTERS OF GROBET SWISS FILES — MFRS. OF GROBET ROTARY FILES

NO LOST MOTION HERE IN CONSECUTIVE MARKING

THE No. 9A MARKING MACHINE NUMBERS OR MARKS WITH EACH FORWARD AND EACH BACKWARD STROKE

Deep, clean marking or numbering of tubular and cylindrical parts and pieces is accomplished easily and efficiently with the ACROMARK machine. Minimum of adjustments and simplicity of operation permit untrained personnel to produce perfect work at all times with hand operated or motor driven machines. Write for literature describing the complete ACROMARK line of marking, stamping and numbering machines and accessories; no obligation.





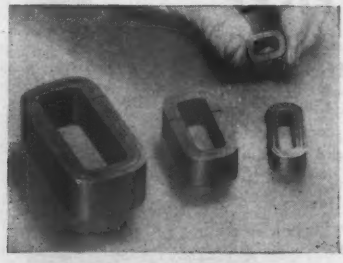
AUTOMATIC NUMBERING HEAD

Heavy, rugged construction assures long life even when used on untempered steel and stainless steel.

ACROMARK

THE ACROMARK COMPANY
615 MORRELL STREET ELIZABETH, NEW JERSEY

"C" Hipersil Cores Have Variety of Communications Applications



THE new Westinghouse line of type "C" Hipersil Cores is designed for a variety of applications in the communications field—for radio transformers, chokes, relays, reactors and loading coils.

The type "C" cores save man-hours and simplify assembly and replacement, since only 2 or 4 pieces are involved. Construction of the Hipersil core involves winding the Hipersil strip continuously on a mandrel of desired dimensions. It is annealed at high temperature and vacuum impregnated with a plastic compound to make it a solid unit. It is then cut in two segments, the ends of which are machined and worked to produce coinciding surfaces when reassembled. A check test is made for fidelity of performance. Cores are assembled on coils by means of metal bands tightened to insure correct tension.

For frequencies up to 400 cycles, type "C" Hipersil steel cores of nominal gauge are used. For frequencies higher than 400 cycles, a core using thinner Hipersil steel has been designed, and for very high frequencies and exceptional fidelity, a still thinner gauge is available.

Further information may be secured from Dept. 7-N-20-J, Westinghouse Electric and Mfg. Co., East Pittsburgh, Pa. 35-B

Amazing S-22 Synthetic

ETCHING STAMPS

Thousands of our new "S-22" Synthetic stamps now in service have proved that this new material outlasts rubber or other synthetics by from 3 to 4 times, when used with acid etching inks. Order "S-22" next time you need inspection stamps.

INSPECTOR'S KIT

Made of acid proof, non-critical material, this new Kit holds stamps, etching ink, ink pad and neutralizer. Inexpensive, compact and convenient. Write for quotation.

Write for Bulletin S--Catalog 146

This valuable bulletin illustrates the various styles of stamps available. Write for your copy today.

JAS. H. MATTHEWS & CO.

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New York, Boston, Chicago, Philadelphia, Newark, Syracuse

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HERE'S A BETTER, FASTER WAY TO SPEED THE BURRING OF HOLES!

NOBUR

1. NOBUR's double-edged cutting blade instantly removes burrs around holes in flat or curved surfaces of single or multi-walled parts—smoothly and accurately.

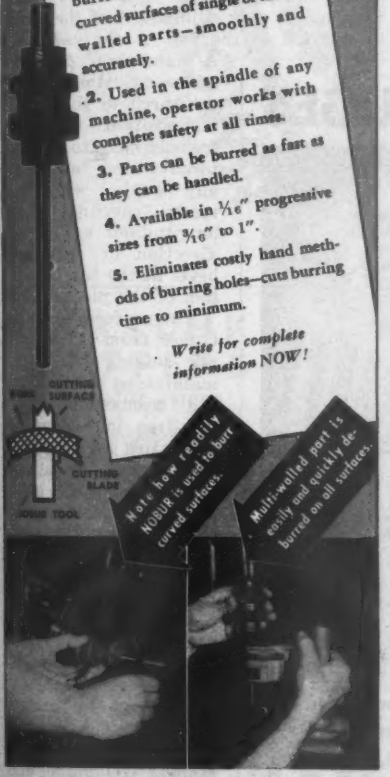
2. Used in the spindle of any machine, operator works with complete safety at all times.

3. Parts can be burred as fast as they can be handled.

4. Available in 1/16" progressive sizes from 3/16" to 1".

5. Eliminates costly hand methods of burring holes—cuts burring time to minimum.

Write for complete information NOW!


CUTTING SURFACE
CUTTING BLADE
NOBUR TOOL
Note how readily NOBUR is used to burr curved surfaces.
Multi-walled part is easily and quickly deburred on all surfaces.

NOBUR MANUFACTURING CO.
912 NO. ORANGE DRIVE, LOS ANGELES, CALIF.

A RADII & ANGLE DRESSER
OF PRECISION AND VERSATILITY

MODEL B

An instrument of precision and versatility . . . Operation is simple, requiring no high degree of skill for accuracy . . . Any one of the following can be produced with one setting:

One angle
Two angles
Concave radii up to 6"
Convex radii up to 4½"
Two Angles and radius.

Many other diversified forms to meet requirements.

Wheel size capacity—4"–14" dia.: angular travel 3"; for use on universal surface and cylindrical grinders.

Full details available on request.

MANUFACTURED BY
J & S. TOOL CO. 477 Main St., East Orange, N. J.
PRECISION DRESSING TOOLS

Close Tolerance Shape Cutting

ACCURACY in cutting, compactness of size, ease of control and economy of operation are built into the new JR. It is designed to handle all cutting jobs from the smallest up to an overall size of 3' x 4'.

An important fact which accounts for the accuracy-of-cut obtained with this cutting machine is that a number of the proved operating and construction features of this machine have been adapted from National's large type R.

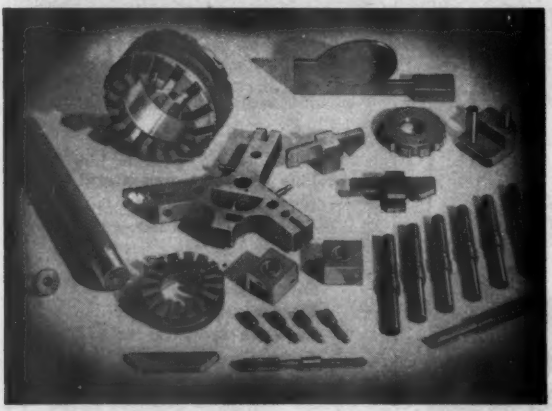
The end positioning of the torch provides quick, easy adjustment of the torch in relation to the end of the carriage. A handwheel provides micro-adjustment of the torch to the starting position. It is extremely easy to set the torch to cut bevels at any angle, with the torch traveling in a longitudinal or lateral direction or with the bevel at the top or bottom of the plate.

The uniform speed of travel from 2" to 36" per minute which is maintained by the driving mechanism; friction-free movement of the entire carriage; vibration-free construction of the torch holding mechanism; and the outstanding performance of the cutting torch are contributing factors in producing precision cuts with the JR.

Template and manual tracers can be interchanged in a few minutes. Tension and driving rollers grip the tracing template and follow its exact contour.

National Cylinder Gas Co., 205 W. Wacker Dr., Chicago, Ill., has new literature. 133-B

WALTHAM GAUGES



★ SPLINE & INVOLUTE ★

★ GAUGES A SPECIALTY ★

★ We manufacture all types of precision limit gauges. Either standard or specially built to your requirements. Fast, dependable service. Finest craftsmanship. ★

★ *Call WALTHAM on your next job.* ★

WALTHAM GAUGE COMPANY

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KEEP SPOILAGE DOWN
Rawhide
Hammers & Mallets
Replacement insert faces for C/R Hammers sold by leading supply houses.
KEEP PRODUCTION UP

Coiled Mechanical Rawhide absorbs shock without fatiguing recoil. Delivers effective, forceful blows without crashing, battering or marring. Speeds assembly, die setting, machine adjustment, motor repair and maintenance work. Keeps production up and spoilage down.

Write for Catalog Sheets

CHICAGO Rawhide MFG. CO.
1280 ELSTON AVE. ★ CHICAGO, ILLINOIS.

MARSCHKE BUFFERS

at CURTISS-WRIGHT

e Airplane propeller blades are polished with light MARSCHKE Swing Frame Buffers at the Caldwell, N. J., plant of Curtiss-Wright.

These highly maneuverable machines are as efficient for buffing awkwardly shaped work pieces or flat metal surfaces as are Marschke Swing Grinders for cleaning steel slabs and castings. If your job is similar, a Marschke will definitely speed and improve your work.

Marschke Swing Frame and Pedestal Buffers are made in sizes from 1 to 15 HP., single and selective speeds. Write for Bulletin No. 47.

The MARSCHKE LINE

manufactured and sold by

VONNEGUT MOULDER CORP. 1853 Madison Ave. Indianapolis 2, Ind.

Hook Checker for Rake Angles

A UNIVERSAL hook checker, designed to enable rapid, accurate checking of hook or rake angles and flute spacing in sharpening thread milling cutters, has just been announced by Detroit Tap & Tool Co. Visual aligning of a ground straight edge with the face of the cutter flute permits the operator to read the offset distance directly from an integral micrometer barrel. Simple placement of an indicator finger against the cutting face enables any error of flute spacing to be read directly on an integral indicator dial. Use of this machine, it is said, eliminates the conventional time-consuming, cumbersome positioning and adjusting methods of checking sharpening accuracy.

Much of the simplicity of operation is made possible by the checker design. The machine has only three principal components—a base mounted on a pedestal, an adjustable cutter mount with a dual head, and the hook and flute spacing measuring assembly. The lower cutter mounting center is fixed to the base. Upper mounting centers are attached to a support which is adjustable vertically to accommodate various lengths of cutters.

The measuring assembly in which the ground straight edge finger and the indicator are mounted is provided with a vertical adjustment controlled by a hand wheel. The two micrometer barrels which control the movement of the straight edge for right and left hand offsets respectively are calibrated to measure the offset distance from a radial line.

Detroit Tap & Tool Co., Detroit, Mich., has further information. 134-B

AVAILABLE NOW!

TRUEPLANE SURFACE PLATES

Outwear Cast Iron or Steel!

This structural glass plate remains flat longer than cast iron or steel and is more accurate. Abrasion resisting qualities are better than tool steel. Surface is precision lapped to an overall flatness of less than .0002". Doesn't warp or twist, not affected by temperature changes. Stock sizes immediate delivery, two weeks delivery on other sizes. Size 14" x 18", $49.00; 16" x 20", $58.25; 20" x 24", $87.50, F. O. B. Cleveland.

Also suppliers of Die Springs, Dowel Pins and other Die Maker's supplies.

DIE SUPPLY CO.

J. R. Fitzsimmons W. H. Fitzsimmons Jos. T. Fitzsimmons

4751 Hough Ave. CLEVELAND, O. EXpress 1133

Chambersburg Engineering Company, Chambersburg, Pa., manufacturers of hammers and other forging equipment, announce the election of George R. Murray as vice president and of Edgar S. Hutton as vice president and a director.

ARMY-E-NAVY

"E" TO UNIVERSAL FOR OUTSTANDING ACHIEVEMENT IN THE MANUFACTURE OF VITAL TOOLS

We are proud to announce that we have been awarded the coveted Army-Navy "E" in recognition of the quality and quantity of the Universal precision parts we have been producing for the war effort. You can improve production with Universal Collet Chucks which grip as strong as solid steel in both a radial and axial direction without marring shank. Write for facts.

UNIVERSAL ENGINEERING CO.
FRANKENMUTH • MICHIGAN

SPECIALISTS IN MULTIPLE DRILLING EQUIPMENT

Our Complete Facilities and Long Experience in Making Multiple Drilling Equipment for

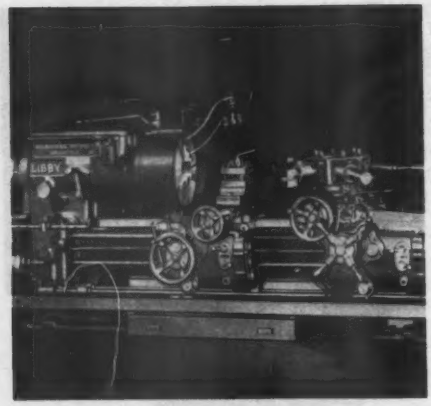
DRILLING . . . REAMING . . .
SPOT FACING . . .
COUNTERBORING . . .
TAPPING, Etc.

especially qualify us to take care of your individual requirements. Our Engineering Department gladly offer their services. Write us, giving details.

Pictured Above

is a special Hydraulic Drilling Machine; 9-spindle Drill Head Bushing Plate and Indexing Fixture.

MICHIGAN DRILL HEAD CO.
8711 E. 8 MILE ROAD HAZEL PARK, MICH.



New Model Turret Lathe

THE new line of Libby Type H heavy duty turret lathes, recently announced, incorporates new features and standardizes sizes for both the regular line of heavy duty turret lathes and the fixed and sliding bed type machines.

The five standard sizes of Libby Lathes are built with different size spindle bores to accommodate various classes of work. In addition, cross ribs are properly spaced to provide an exceptional degree of strength to resist torsional stresses and strains that may occur under most severe operating conditions. Elliptical chip chutes are cast in the center of the bed to direct chips to the back of the machine where they may be easily removed.

Spindle Control is obtained by means of a lever on the headstock which operates the clutch and spindle brake simultaneously. A sturdy multiple disc brake is automatically applied to the spindle when the lever is in neutral position. The headstock transmission provides 8 spindle speeds. Sixteen speeds are obtainable with a two speed, 1800-900 rpm motor. A rheostat and DC voltage motor will give a variable speed range. It is necessary to choose the proper spindle speeds for all materials and work diameters to receive the most efficient cutting speed.

The fixed center hexagon turret is usually furnished for high production and permits

(Cont'd on Page 210)

Here's What You Need For . . .
MANY TEDIOUS JOBS
Time—our most valuable asset today—can be saved by the use of a Duro Hand Grinder. Cutting, grinding, polishing, etc. on small parts requiring hand work, is easily and rapidly executed.
Duro Hand Grinders are powerful and durable. The G. E. Universal Motor develops 42 watts output running at 24,000 R.P.M. Kept cool in operation by propeller type fan. Spindle operates on sealed N. D. ball bearings which take up all radial and thrust load. Fitted with collet chuck up to ⅛" capacity. Streamlined to fit operator's hand. Ideal for tool post grinding.
Ask for details and list of accessories
Duro Metal Products Company
2933 N. Kildare Ave. CHICAGO, ILL.
DURO HAND GRINDER
DURO DURABILITY
FOR DIE WORK
FOR TOOL POST GRINDING
FOR POLISHING
FOR ROUTING
FOR DRILLING
FOR

NEW BOOKLET *Describes*
LIGHTWAVE MEASUREMENT

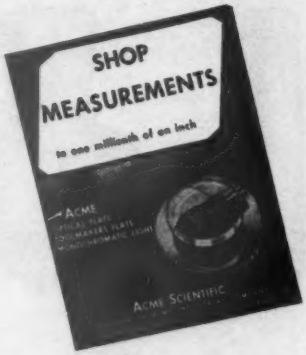
★

It's Yours For The Asking!

Just off the press . . . Acme's new booklet, "SHOP MEASUREMENTS to one millionth of an inch", describes in simple detail how Acme Optical Flats are applied in the procedure of lightwave measurement.

Illustrations and diagrams show how these flats can be used to check surface flatness, as well as their use for accurate comparison measurement in connection with precision gage blocks.

In short, this new booklet has been written in non-technical terms to make it easy for the average mechanic to thoroughly understand how to apply lightwave measurement in shop practice.



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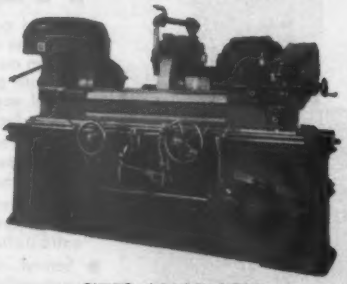
HILL-CLARKE
Modernized
CYLINDRICAL GRINDERS
for **SUPER-GRINDING**
and **MICRO-FINISH**

Hill-Clarke Modernized and Motorized Cylindrical Grinders offer refinements in design which minimize vibration and assure extreme accuracy on all grinding operations. One of these refinements, the Hill-Clarke Patented Multiple V-Belt Drive to work spindle, contributes to the smoothness in operation which makes possible a finish within a few micro-inches even when using standard grain free-cutting wheels. Investigate today by sending for a copy of the Hill-Clarke catalog "Super Grinding."



SIZES AVAILABLE

10x36	10x72	14x72	16x72
10x50	14x50	14x96	18x96

HILL-CLARKE MACHINERY CO.
646 WASHINGTON BOULEVARD CHICAGO, ILL.

Ring Style Holders for Curved Line Stamping

A NEW line of ring style holders, designed for curved line markings of parts from ¼" to 6" in diameter, has been developed by Jas. H. Matthews & Co. These holders are engineered for use in high speed production stamping equipment, or in hand-style units where marking of parts may be limited. In this case, the "Safe-Hed" feature is provided in the head of the holder.

The new ring style holder is economical for use with segment type, which is engraved with one character only, or logo dies, engraved with two or more characters, from 1/32" to ½" in size. Its dovetail self-locking segment type for positive holding provides quick and easy changing of type.

These holders are recommended for marking rounds, dials, bearings, tubing rims and special parts, whether the surface is recessed, concave or convex. Ring Style Holders are custom built and engineered to fit the marking need. Spacing of characters, type capacity, in curved line or combined straight and curved line arrangement, are provided to mark all types of products.

Permanent lettering can be engraved on multiple character logo dies. Single type is used for changeable lettering. Interchangeable single character type can be set up in full or part ring, depending on the marking required.

Jas. H. Matthews & Co., 3896 Forbes St., Pittsburgh, Pa., has new literature. 139-B

HOLLAND MILLER

With

SWIVEL HEAD

This rigid and versatile miller answers the need for a flexible toolroom and production machine with an unusually wide range of speeds. Note these exclusive features:

- Controls of table and head are all reached conveniently from the operator's seat.
- Rigid table mounting at permanent height provides extra stability and accuracy.
- Swivel Head, with motor centered above spindle, has 8" travel and 3" quill feed.
- A wide range of speeds, 200-4375 RPM, with standard motor, or ⅓ less with slow speed motor, is offered for boring and high-speed milling.

IMMEDIATE DELIVERY

Write TODAY for complete specifications and descriptive details.

J. W. HOLLAND CO.

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FROM STOCK
We mean just that! Immediate delivery assured through our vast manufacturing facilities.
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TOOL COMPANY
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CENTER DRILLS
LATHE MANDRELS
ACTUAL PHOTO OF TRU-CUT GOLD TIP BIT. 11/16" CUT. .020 FEED. 1020 SAE STEEL.
KEY SEAT CUTTERS

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BOYAR-SCHULTZ SMB BOLTS

Save the Machine, Save the Job, Save Time

Poorly made machine bolts or bolts that have become worn and distorted can cause great damage to the accuracy of machine beds. Accuracy thus destroyed can be restored only at considerable expense and loss of time.

SMB BOLTS ARE MADE FROM ALLOY STEEL

Boyar-Schultz SMB Bolts are made from alloy steel, heat treated for maximum properties. They are machined with head square with body, assuring a clean, flat bearing surface to fit the upper side of T-slot. Work is held tightly under heavy machine cuts and close adjustments are possible.

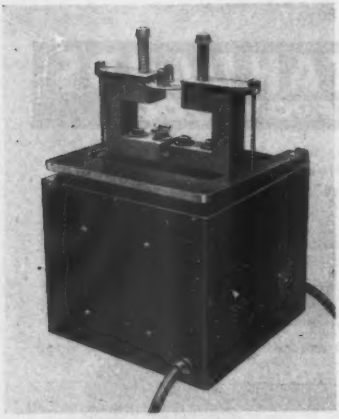
For best results use SMB Nuts and Washers. They are specially made for SMB Bolts.

SMB Nuts specially made to fit SMB Bolts. Clean cut threads.
Alloy Steel heat treated for strength and toughness.
Head machined square with body.

★

Boyar - Schultz Corporation

2112 J Walnut Street Chicago 12, Illinois



Berwick Electric Metal Heater

A NEW Type T-37 soldering transformer, illustrated, has been announced by American Car & Foundry Co. It is 9¾" x 9¾" x 8¾", not counting the top portion of the transformer. The disc is of brass, about ⅛" thick and 2½" in diameter. On it are crimped two brass cups with a ring of soft solder between the cup and the brass disc.

By pressing down on the transite board, the front edges of the copper pressure shoes spring up so that the disc can be slipped in. The disc is firmly pressed to the electrodes by the pressure of the operator's hands.

With a load of 9½ amperes on 220 volt, the soft solder is run in 11 seconds. Thus about 300 of these discs per hour can be soldered with about 2 kwh.

On the dials in the front of the Type T-37, A is high and B is low. Since there are five heat speeds, this gives ten heat ranges for the various grades of work.

The transformer has a primary capacity of 4 kva; a secondary capacity from 2 to .7 kva; two primary coils in series; 1 turn secondary and a voltage range from .3 to .9.

American Car & Foundry Co., 30 Church St., New York, N. Y. 137-B

(Cont'd from P. 206)

the use of multiple tooling setups, such as overhead piloted multiple turning and facing heads, piloted boring bars and special tooling that combines several cuts. The cross sliding hexagon turret efficiently handles wide varieties and small lots of work.

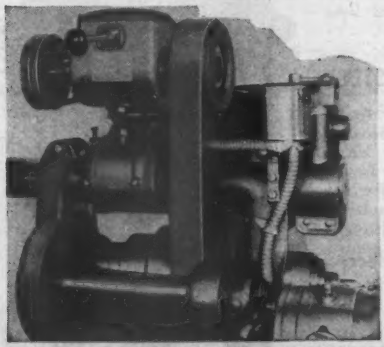
International Machine Tool Corp., Indianapolis, Ind., has available descriptive literature. 135-B

LATHES, MILLING MACHINES

shapers, turret lathes, radial drills, slotters, etc., are motorized with WESTERN MASTER (1-5 h.p.) Transmissions with bracket $95

WESTERN MAJOR (5-10 h. p.) Transmissions with bracket $145

and a WESTERN SUPER (up to 30 h. p.) for replacing gear boxes on large boring mills, radials, Gisholt milling machines, etc.



We can also supply necessary V-belts, sheaves, out-put pulleys and motors from stock. Prompt deliveries on high priorities.

up to 30 h. p.

WESTERN TRANSMISSIONS

WESTERN MANUFACTURING CO. 1400 SCOTTEN DETROIT MICHIGAN

What is DIE-LESS DUPLICATING?

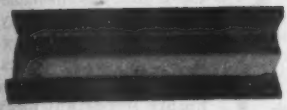
Here is a simple 3-STAGE explanation:

"DIE-LESS DUPLICATING" might be described as a new industrial technique made possible by the accuracy, extreme adaptability and ease of operation of DI-ACRO Precision Machines—Shears, Brakes, Benders —especially when used as a continuous, integrated production process.

←1ST STAGE . . .

Cutting flat material to size and shape for part to be duplicated. The DI-ACRO shear rapidly resizes and squares material, also makes slits, strips, notches, angle cuts, etc. Guides, stops and blade pitch are all quickly adjustable. 3 sizes—shearing widths 6", 9", 12".

SHEARS



←2ND STAGE . . .

Forming angles, channels or "Vees" from sheared flat material. The DI-ACRO Brake forms any angle from 0° to a maximum of 110°. Contact surfaces are adjustable and may be slotted, recessed or altered as needed for the parts required. 3 sizes—folding widths, 6", 12", 18".

BRAKES

←3RD STAGE . . .

Bending sized and formed material to simple, compound or reverse curves of desired radii. The DI-ACRO Bender handles angle, channel, moulding, rod, tubing, wire (round, square, flat), strip stock and other ductile materials in a remarkably wide range of accurate contour forming. 3 sizes—radius capacity 2", 6", 9", handling up to ½" cold rolled steel bar.

BENDERS

DO YOU HAVE DUPLICATE PARTS TO FORM? . . . .

The DI-ACRO System of METAL DUPLICATING WITHOUT DIES has proven its adaptability in making parts just as accurately as can be done with dies, to a tolerance of .001" in all duplicated work. The delay of waiting for dies is avoided—deliveries speeded up. Changes needed in production can be made simply by adjustment of DI-ACRO Precision Machines, which are also widely used for laboratory and research work, making models, etc. Production work is often done in excess of 1,000 operations per hour, by girls or inexperienced workers.

Send for Catalog—
"METAL DUPLICATING WITHOUT DIES"

It gives full details on all models of DI-ACRO Shears, Brakes, Benders, and many examples of parts made with "DIE-LESS DUPLICATING".

O'NEIL-IRWIN MFG. CO.

215 EIGHTH AVE. SOUTH MINNEAPOLIS 15, MINNESOTA

(Continued from Page 121)

sible, by proper choice of frequency and equipment, to case harden desired surface of mechanical parts, such as gears and shafts, and leave the base metal tough and malleable.

Considerable prophecy has already been made by many leading authorities on frequency modulation, television and broadcasting. Important developments in the field of communication in the past year lead to vast expansion in the number of frequency modulation and television sets. Even in present broadcasting the trend of ever increasing power leads us to predict the building of "superpower" broadcasting stations of 750,000 to 1,000,000 watts output.

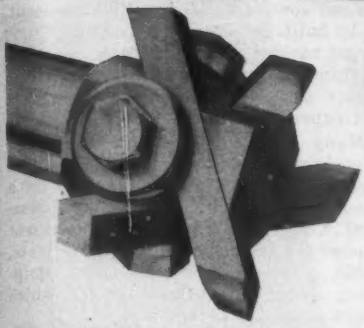
Carrier current transmission, a less known phase of communication, has found increasingly wide application in the past few years. Its use in connection with protective relaying has permitted the capacity of our present power lines to be increased over 50 percent, with a comparable saving in vital copper and other critical materials. Telemetering, or the remote indication of circuit and plant loading to a central dispatcher in the power distribution system, is another application of carrier current developments. This application facilitates the economic operation of power generating systems. As the power needs of the country grow, this industry will find wartime developments in electronics of assistance.

Developments in the field of electronic devices for making measurements include dynetric balancing, the electron mass spectrometer, cathode ray, stroboglow, micrometers and many others. Dynetric balancing is highly important today as it measures and locates the position of off-balance components of all types of rotating parts from the tiny aircraft instrument gyros weighing less than a quarter of a pound to the massive marine gears weighing over 80 tons. In the conventional sizes, rotors weighing from ½ pound to one hundred pounds are often balanced in less than 15 seconds. Former methods required more than one hour. Off-balance components producing vibrations of as low as three thousandths of an inch can be accurately measured electronically and the position for a balancing weight located within two degrees. This development will

(Cont'd. on Page 214)

Ditch-Defying Bits
For our boys in Britain who persistently hop the "ditch", we have overwhelming admiration and gratitude.
Every time we hear that "all our planes returned safely", we know that we are effective in our part of the effort to keep 'em flying.
Why? Because we are producing small parts, in quantity, engineered to within .00005 of absolute, that are helping to eliminate the many plane failures caused by failure of small parts in the past.
We make 33 diversified types of gages, too, of identical accuracy; also jigs, fixtures and form tools, for manufacturers of precision products. Inquiries command our immediate and interested attention.
GO
PRECISION
AUTHENTICATED
NO-GO
ELECTRIX
Corporation
Peace-time engineers of soft-rubber connectors for electrically-operated equipment
150 MIDDLE ST., PAWTUCKET, R. I.

a totally different kind of



FACING TOOL

IMPOSSIBLE? *You bet not!* Every claim made for this tool *can be proved!*

1. Replaces End, Shell, Slab Mills, and Inserted Tooth Cutters;
2. Fits all vertical and horizontal milling machines, drill presses and other spindle machines;
3. Quickly and accurately adjustable, just four tool sizes cover all fractional diameters from 1¼" to 5";
4. Slashes tool costs up to 75%;
5. Clark tool blades are not ruined by hard spots in castings, re-extruded Dural, etc.—bits may be quickly touched up and sharpened free hand;
6. Tool blade life is unusually long, replacement cost low;
7. Cuts any material under the most severe operating conditions accurately, swiftly, economically;
8. Ample blade clearance avoids chip clogging and resultant slow-downs;
9. Tools available with all types of blades, including carbide tips;
10. Prompt delivery on suitable priority.

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Get the facts about Clark Adjustable Hole & Fly Cutters—they, too, are remarkable new-type tools!

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3424 SUNSET BOULEVARD, LOS ANGELES 26
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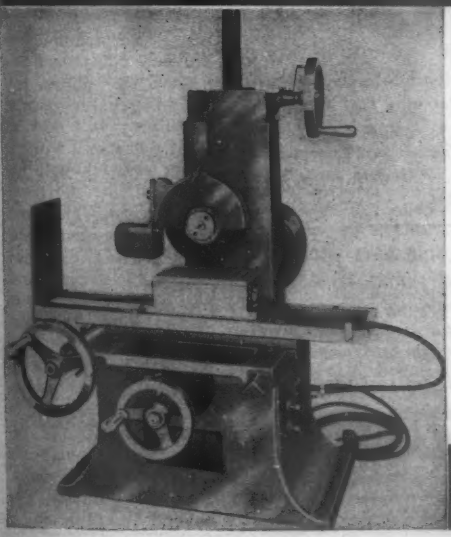
Sanford precision bench surface grinder



A
HIGH SPEED GRINDER
FOR ALL
SMALL PRECISION WORK

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Write for
Specifications
Bulletin No. C

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IMMEDIATE DELIVERY

SANFORD MFG COMPANY
1279-81 SPRINGFIELD AVE. IRVINGTON 11, N. J.

(Continued from Page 212)

be of increasing importance in helping to build longer life machines with quieter and more dependable operation.

Westinghouse has been active for many years producing electronic lighting controls, photo-electric devices, smoke recorders, resistance welding controls and motor speed controls. In resistance welding Westinghouse is at present producing many welding timer units for use in plants welding vital plane parts.

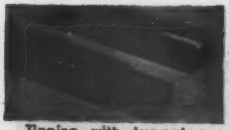
A rather recent development has been the Mot-O-Trol, an electronic device which permits the operation of d-c motors from an a-c power source, with a wide range of speed control, good speed regulation and current limiting acceleration. The speed is controlled with precision from a remote pushbutton station that permits the operator to maintain instant control at all times. At present, it is built in sizes up to 15-hp, with larger ratings probably soon to come. In machine shops and the machine tool industry this means increased production and superior products.

Many types of electronic equipment have been developed for use in the inspection and sorting of products in a diversified group of industries. Industrial X-ray, for instance, is at present applied for the inspection of armor plate, welds, airplane parts and other equipment, spotting certain defects which might otherwise escape notice.

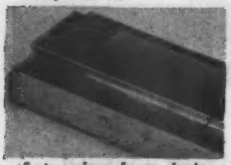
The precipitation of dirt and dust particles, fumes and smoke has had an important place in film processing laboratories, precision instrument factories and arsenal plants. In machine shops, a Precipitron has removed as much as 4 gallons of oil a day from the air surrounding a high speed lathe.

Radar, the great development of this war, will have many applications to the transportation industry when the demand for military equipment has passed. Our planes will fly in greater safety, our liners will dock at their berths without delay even though fog shrouds the course to be covered. The location of every mountain, plane, boat or rock within the danger area will be instantly known to the controlling personnel. It may be used on railroads, reducing the hazard of collisions.

It is not possible to anticipate all the future developments made possible by electronics. The possibilities are beyond imagination.



Tipping with tungsten carbide or stellite. No recessing of shank necessary. Castolin Eutectic Alloy No. 16.



Salvaging form tools broken through dovetail section. Low frictional coefficient. Machinable. Castolin Eutectic Alloy No. 185

Milling cutter salvaged with Castolin Eutectic Alloy No. 16.

SALVAGING TOOLS
MADE EASIER WITH
Castolin Eutectic
LOW TEMPERATURE WELDING

Daily, more and more prominent war plants turn to Castolin Eutectic Low Temperature Welding Alloys for fast, simplified, economical reclamation of "hard-to-get" production tools.

One plant reports salvaging, in but a few minutes at a cost of but a few cents, a tool costing $180. Tools requiring up to 50 weeks for delivery are put back in use in but a few minutes.

LATEST WELDING DATA BOOK "V"
36 pages of valuable facts to improve welding results and speed production, also procedures for salvaging all tools.
FREE! Write Today!

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WELDING ALLOYS COMPANY
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Forgings For All Industries
Rough Turned or Finished Complete

Composite Die Sections • Extrusion Tools • Crankshaft Forgings • Gear Forgings • Die Casting Dies

Rings, Discs, Blocks, Shafts, Hubs, Bars, and Special Shapes.
Tool Steel of all Makes

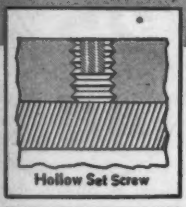
S.A.E. and NE Specifications

STAINLESS & COPPER FORGINGS

May We Serve You?

AJAX STEEL AND FORGE Co.
205 ADAIR STREET **DETROIT, MICHIGAN**

DESIGNED FOR Safety... BUILT FOR Strength



The natural advantages of hollow set screws include safety on revolving or moving parts, ease of assembly in confined places, and more compact construction.

The tremendous holding power of Mac-it Hollow Set Screws makes locking devices unnecessary in all but a few applications. In these cases, Mac-it Hollow Lock Screws are used like jam nuts to prevent any possibility of loosening.

Mac-its
PRONOUNCED "MACK-IT"

Other Mac-it Products Include **Socket head cap screws, Stripper bolts, Hollow pipe plugs, Hexagon head cap screws, Square head set screws.**

Strong, Carlisle & Hammond Company • Cleveland, Ohio

Mill Has Exclusive Five-Way Feature

THE No. 5V is the only vertical mill with what Elkstrom-Carlson & Company calls the exclusive E-C combination five-way feature. By that is meant—first, a ramtype head; second, a swivel head; third, a sliding spindle; fourth, a swivel table; and fifth, a four-way power feed mechanism. Besides the exclusive E-G five-way feature, the mill provides an unusually large capacity, allowing a wide range of potential uses.

The machine may be used in machine tool manufacturing, ship-building, arsenals, moulding and plastics, die casting, and wherever precision tool and die work is of paramount importance.

The machine consists essentially of a base and column casting, a horizontally adjustable ram mounted on the column and arranged to support a swivel sliding spindle head and spindle drivve, and a tilting work table mounted on a saddle and knee assembly arranged to provide longitudinal, cross, and vertical movement of the table—all of which are power driven.

The combined adjustments of the tilting spindle, the tilting table and the ram type head provide all of the advantages of several different milling machines into one compact, vitally different unia. Usually, only one setup is all that is required on 5V. The operator moves the spindle head by loosening two bolts on the ram which carries the head to its working position. The head and table can both be tilted and by simple controls, the table can be moved cross or longitudinally. With these simple adjustments, the operator can mill flat, vertical, horizontal or angle surfaces.

Address Ekstrom Carlson & Co., Dept. VJ., Rockford, Ill., for further information. 152-B.

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Increase Sawing PRODUCTION

25% TO 40%

Your saws will cut faster and truer and stay sharp longer when filed on a Foley Saw Filer, which automatically jointa the saw as it is filed. The exclusive patented Foley jointing principle straightens up uneven teeth and makes them perfect in size, shape, spacing. Foley automatic filing not only increases sawing production 25% to 40%, but greatly reduces saw breakage and doubles the cutting life of your saws. Any man or boy can operate the Foley Automatic Saw Filer, the only machine that sharpens crosscut circular saws 3" to 24" in diameter, band saws ⅛" to 4½" wide—all hand saws. It cuts down filing time and saves on files.

30 DAY TRIAL IN YOUR OWN PLANT. Find out on your own work how much the Foley Filer can save you in increased output, longer saw life and reduced filing costs. Send coupon for details of our 30 Day Trial Offer.

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Send literature and details of your 30-Day Trial Offer.

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MULTIPLE CROSS SLIDE STOP

SETS 6 DIAMETER STOPS FOR REPEAT OPERATIONS

AMERICAN MODEL DS-1

- PREVENTS SPOILED WORK
- INCREASES PRODUCTION
- MAKES IT UNNECESSARY TO WORK BY DIAL GRADUATIONS

All necessary parts are supplied with each Multiple Cross Slide Stop.

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Built by **VARGO**

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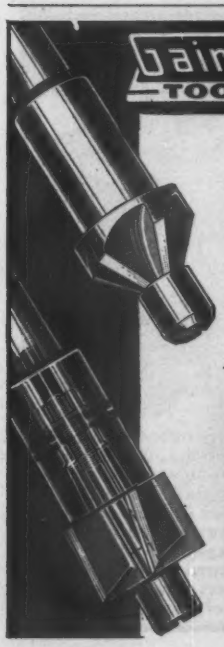
Gairing TOOLS Counterbore Sets



A kit of these efficient tools eliminates costly delays in counterboring and spotfacing. Seven sets from which to choose. Each contains a logical selection of interchangeable counterbores, pilots and holders. *Write for prices and Bulletin C.*

Set C-13, below, consists of 2 holders, 20 cutters ranging from 5/16" to 1¾" and 28 pilots ranging from 3/16" to 1⅛". Two countersinks, ⅞" x 70° and ⅞" x 82° are included, all neatly boxed with hard wood cover.

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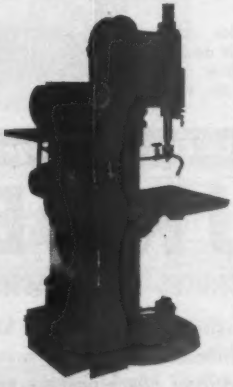

Four outstanding advantages of the new Model DB unit tapping machine are 16 speeds, dual control, 1¼" capacity and precision depth stop. In addition, this model incorporates all the features of the older Model D.

Equipment includes a 3 hp reversing motor for the spindle drive, a motor driven coolant pump and return tank.

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- FULL VISION and CONTROL over job.

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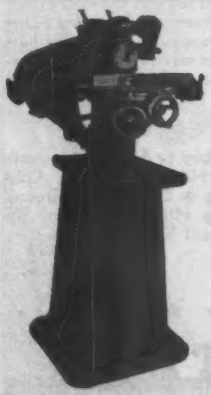

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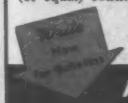

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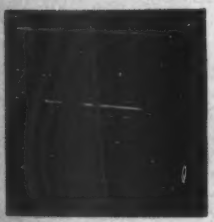

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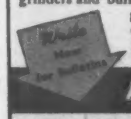

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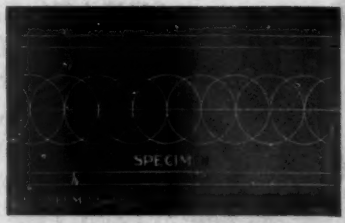

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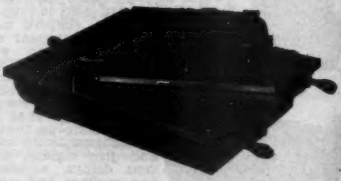

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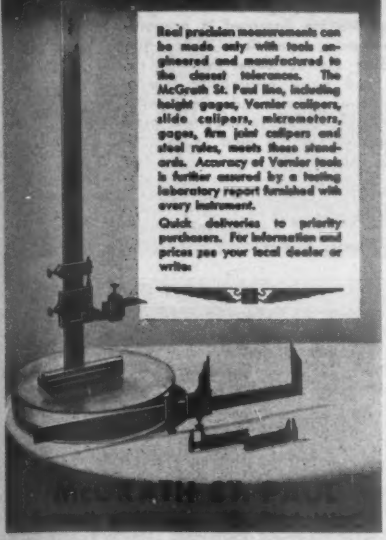

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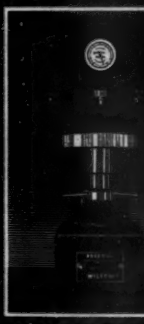

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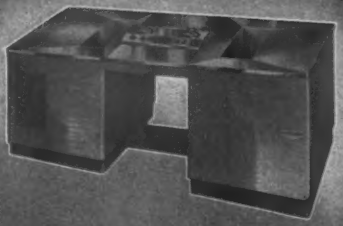

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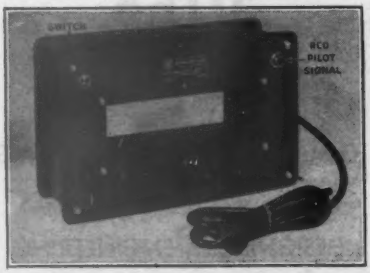
A Tool Room Necessity



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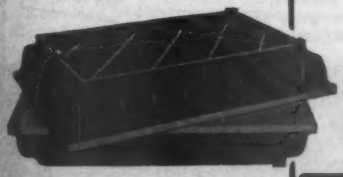

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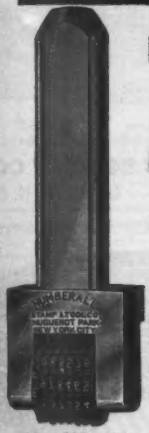

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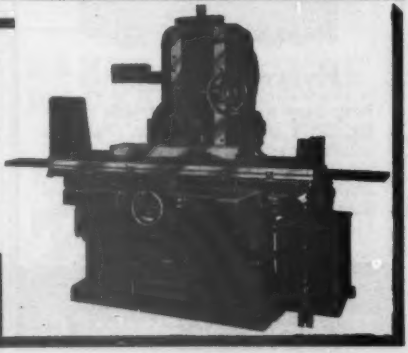

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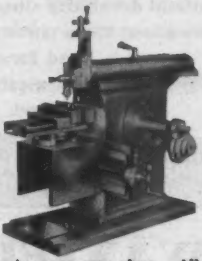

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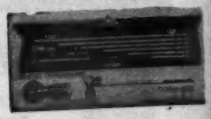

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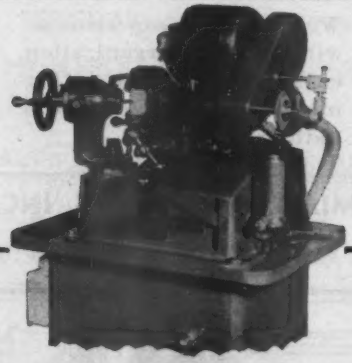

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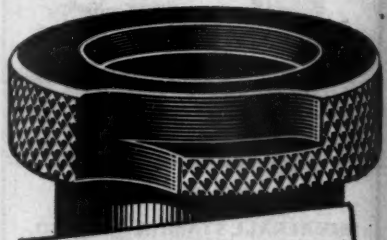

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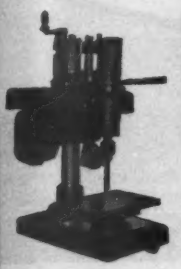

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(Continued from Page 235)

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16 ga., drag holes and handles both ends.

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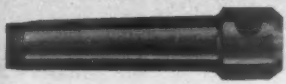
END MILL HOLDERS



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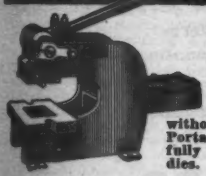

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George F. Wales, President

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ADVERTISERS INDEX

Acme Industrial Company 207
Acme Tool Company 75
Acromark Company, The 190
Advance Plating Company, The 67
Agerstrand Corporation 221
Aget-Detroit Manufacturing Company...221, 262
Ajax Engineering Manufacturing Co. 74
Ajax Steel & Forge Company 215
Alco Tool Company, The 41
Alois Manufacturing Company 229
American Broach & Machine Co. 36
American Cutter & Engineering Corp. 228
American Gauge Company, The 68
American Industrial Publishers 134
American Metal Works, Inc. 218
American MonoRail Company 60
Ames Company, B. C. 168
Anderson & Brown Co. 25
Armstrong-Blum Mfg. Company 244
Armstrong Bros. Tool Company 223
Arnold Tool Company 175
Atlas Equipment Company 189
Atlas Press Company 38
Automotive Maintenance Machinery Co. ... 177
Auto-Ordnance Corporation 19

Barco Scraping Company 145
Bartelt Engineering Company 183
Barth Stamping & Machine Works 230, 235
Bassett Steel Company 219
Blanchard Machine Company 55
Blank & Buxton Machinery Company 16
Boggis & Company, Henry P. 232
Bokum Tool Company 162
Boyar-Schultz Corporation 209
Brand Tool & Supply Company 232
Brewster-Squires Company 226
Bucell Machine & Tool Company 77
Burke Machine & Tool Company 220
Bush Company, J. C. 234

Cadillac Glass Company 192
Carboloy Company, Inc. 27
Carborundum Company, The 30
Carpenter Steel Co., The 156
Cerro de Pasco Copper Corp. 183
Challenge Machinery Co. 166
Chambersburg Engineering Co. 173
Chicago Manufacturing & Distributing Co. 24
Chicago Rawhide Mfg. Company 203
Chicago Wheel & Mfg. Company 17
Cincinnati Grinders, Incorporated 7
Cincinnati Milling Machine Co., The 6
Clark Co., Robert H. 213
Clark Instrument, Inc. 59
Cleveland Tapping Machine Co. 219
Cleveland Twist Drill Company 84
Cleveland Universal Jig Company 235
Climax Molybdenum Co. 144
Colonial Bushings, Inc. 232
Columbia Tool Steel Company 234
Conrad & Moser 235
Continental Machines, Inc. 151
Cooley Electric Mfg. Company 61

Cooper-Bessemer Corp., The 127
Cratex Mfg. Co. 237
Cullen-Friestedt Company 180
Cullman Wheel Company 184

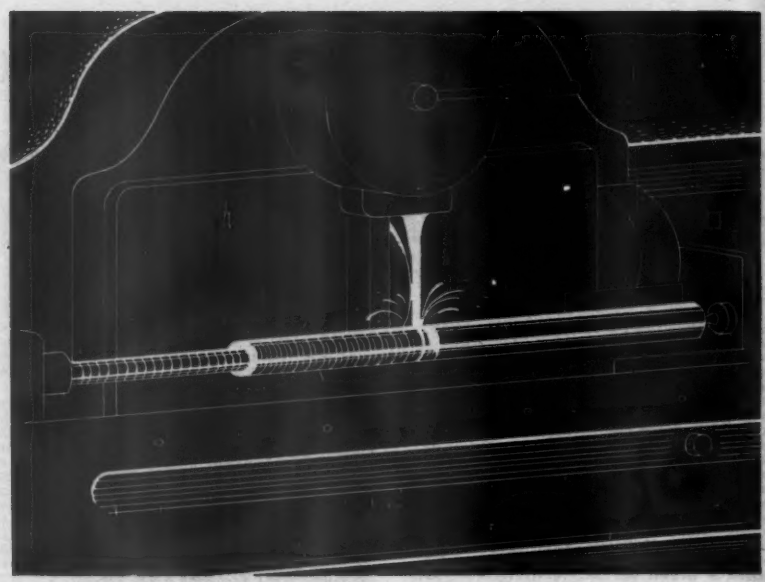
Danly Machine Specialties, Inc. 128
Darwin & Milner, Inc. 189
Davis Tool & Engineering Company 234
Dearborn Gage Company 42
Delta Manufacturing Company 12
Denning Manufacturing Company 235
DeSanno & Sons, Inc., A. P. 98
Dessau Co., Maurice S. 140
Detroit Die Set Corp. 48
Detroit Reamer & Tool Co. 18
Detroit Stamping Company 194
DeVlieg Company 163
Diamond Tool Company (Not Inc.) 227
Die Supply Company 204
Dix Manufacturing Co. 236
Douglas Machinery Company 35, 186
Dreis & Krump Mfg. Company 234
Drexel-Betz Company 234
Drive-All Mfg. Co. 33
Duro Metal Products Company 206
Dykem Company 234

Eastern Engineering Co. 148
Eastern Etching & Mfg. Company 135
Economy Engineering Company 66
Ekstrom, Carlson & Co. 171
Electrix Corporation 212
Enterprise Machine Parts Corp. 9, 234
Erickson Steel Company 223
Eutectic Welding Alloys Co. 214
Evans Reamer & Machine Company 227
Ex-Cell-O Corporation 40

Federal Products Co. 53
Federal Tool Corporation 78, 234
Firth-Sterling Steel Company 49
Foley Manufacturing Company 216
Forging and Casting Corporation, The 2

Gairing Tool Company, The 218
Gallmeyer & Livingston Company 231
Galter Manufacturing Company 181
General Die-Stamping-Tool Co. Precision Collet Div. 81
General Die & Tool Company 235
General Tool & Die Corporation 63
Gibson Co., William D. 191
Gilbert & Barker Mfg. Co. 188
Gilron Products Company 240
Gorton Machine Company, George 157
Gottscho, Inc., Adolph 237
Gray-Mills Company 73
Grinding Machinery Tool & Supply Co. ... 222
Grobet File Company of America.....190, 231

Hamilton Tool Company 231, 233, 236
Hammond Machinery Builders, Inc. 190
Hardinge Brothers, Inc. 3
Hartford Chrome Corp. 56
Hartford Special Machinery Co., The ..230, 234



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Hacker, A. W. 31
Heimann Manufacturing Co. 228
Hill-Clarke Machinery Company 207
Holland Co., J. W. 208
Hole-Krome Screw Corporation, The 5
Hovis Screwlock Company 138

Ideal Machine Tool Co. 187
Industrial Machine Co. 235
Industrial Products Suppliers 233

J & B Specialties 233
J & S Tool Company 201
Jefferson Machine Tool Company 72
Jessop Steel Co. 165
Johnson Gas Appliance Co. 196

Kearney & Trecker Corp. 58
Kempsmith Machine Company 60
Kennametal, Inc. 161
Kent Aircraft and Gauge Co. 232
Kiffer Tool & Die Company 235
Kux-Vise, Inc. 153
Koebel Diamond Tool Co. 230
Kold-Hold Manufacturing Co. 228
Krauth & Benninghofen 233

Lakeside Steel Improvement Co., The 172
Lapointe Machine Tool Company 28
Lauer Tool & Gauge Co. 228
Lavallee & Ide, Inc. 32
Leach Machinery Company, H. 227, 230
LeBlond Machine Tool Co., R. K. 71
Lee Company, K. O. 181
Lempco Products, Inc. 11
Leslie Welding Company 237
Lewis Machine Tool Co. 232
Lima Electric Motor Company, The 37
Lincoln Park Manufacturing Co. 229
Lintern Corporation, The 139
Logan Engineering Co. 164
Lorain Machine & Tool Company 235
Lucas & Son, Inc., J. L. 20, 237
Lufkin Rule Company, The 224

Machinery Manufacturing Co. 51
Majestic Tool & Mfg. Co. 234
Manufacturers Supply Company 195
Master Machine & Tool Co. 178
Matthews Co., Jas. H. 200
McGrath St. Paul Co. 225
McKinney Tool & Manufacturing Co. ..149, 235
Mead Specialties, Inc. 223, 225
Mechanite Research Institute 242
Melin Mills 34
Metal Carbides Corp. 152
Mercury Metal Die & Letter Co. 129
Mars Engineering Co. 179
Meyers Co., Inc., W. F. 142, 143
Miami Industries, Inc. 231
Michigan Chrome and Chemical Co. 219
Michigan Drill Head Co. 205
Moore Special Tool Co., Inc. 220
Motor Tool Manufacturing Co. 167

National Acme Co., The 21
National Twist Drill and Tool Co. 8
Needham, E. H. 182
Noble & Stanton, Inc. 235
Nolur Manufacturing Co. 201
Norton Company 141
Numberall Stamp & Tool Co. 231

Ohio Tool Company 82, 83, 235
Oliver Instrument Company 185
O'Neil-Irwin Mfg. Company 211

Paramount Tool Co. 235
Peninsular Steel Co. 226
Penrod & Sons Tool & Engineering Co., Floyd 179
Perfex Gage & Tool Co. 57
Phoenix Machine Co. 235
Pipe Machinery Co., The 10
Precunier Safety Chuck Company 155
Producto Machine Company, The 195
Putnam Tool Company 1

Quality Tool & Die Company 13

Rane Tool Company, Inc. 235
Research Tool Co. 79
Rivett Lathe & Grinder, Inc. 54
Robbins Engineering Company 234
Roberts Rubber Co., Weldon 176
Rockford Die & Tool Works, Inc. 234
Ross Co., David J. 193
Royal Oak Tool & Machine Co. 234
Rusnok Tool Works 237
Ruthman Machinery Co. 237

Sanford Mfg. Company 213
Say-Way Industries 29
Scherr Co., Inc., George 26
Schraner & Company, A. P. 235
Schultz & Anderson Co. 217
Sheldon Machine Company, Inc. 154
Shore Instrument & Mfg. Co., Inc., The 237
Smillie & Co., C. M. 23
Smit & Sons, Inc., J. K. 158
Smith Tool & Engineering Co. 185
Sommer & Adams Co., The 136, 137
Somerset Industrial Diamond Co. 221
Sessner Co. 187
South Bend Lathe Works 52
Springfield Machine Tool Company 80
Standard Electrical Tool Co. 225
Standard Pressed Steel Company 191
Star Machine & Tool Co. 236
Strong, Carlisle & Hammond Co. 215
Sturtevant Co., P. A. 198
Stuart Oil Co., D. A. 226
Sunnen Products Co. 169
Super Tool Company 159
Superior Salvage Co. 233
Sutton Tool Company 45
Swanson Tool & Machine Corp. 170

Tannewitz Works, The 64
Taylor Machine Co., The 236
Tool Engineering Service Co., Inc. 239
Tools & Gages, Inc. 70, 236
Toolthrift Company 237
Trico Products Corp. 160
Triplex Machine Tool Co. 229
Tru-Cut Tool Company 209
Tungsten Electric Corporation 28
Turner Gauge Grinding Company 44

United Precision Products Company 150
U. S. Machine Tool Mfg. Corp. 236
United States Treasury 50
Universal Engineering Company ..193, 197, 205
Universal Vise and Tool Co. 30
Universal Wheel & Abrasive Corporation .. 76

Vargo Welding & Engineering 217
Variety Machine & Stamping Co. 236
Victory Safety Hammer Corp. 222
Viking Tool & Machine Corp. 235
Vimco Manufacturing Co. 225
Vonnegut Moulder Corporation 203

Wales-Strippit Corporation 238
Wall Sales Corporation 220
Waltham Gauge Company 202
Walton Company, The 197
Welch Industries, Inc. 14, 15, 243
Welding Equipment & Supply Co. 43
Wesson Company 46
Western Manufacturing Company 210
Wheel Trueing Tool Company 47
Wheelock, Lovejoy & Company, Inc. 222
Wilson, K. H. 65
Wilson Mechanical Instrument Co., Inc. .. 226
Wittek Manufacturing Co. 62

Yoke Supply Co., Wm. S. 233

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5-16-SS	5/16	.2500	.2344	.2188	1⅝	½	3½	2.70
5-16-LS	5/16	.2500	.2344	.2188	1⅝	⅜	6	3.15
3-8-SS	⅜	.3125	.2969	.2813	1⅝	⅜	4	2.90
3-8-LS	⅜	.3125	.2969	.2813	1⅝	½	6½	3.25
7-16-SS	7/16	.3750	.3594	.3438	1⅝	⅜	4½	3.15
7-16-LS	7/16	.3750	.3594	.3438	1⅝	½	6½	3.65
1-2-SS	½	.4375	.4219	.4063	1⅝	½	5	3.45
1-2-LS	½	.4375	.4219	.4063	1⅝	½	7	4.10

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Order by This Number	Screw Size	Pilot Diameter 1	Pilot Diameter 2	Pilot Diameter 3	Cutter Diameter	Shank Diameter	Length Overall	Net Price Each
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5-16-1T	5/16	.2500	.2344	.2188	1⅝	#1 Morse	6	3.25
3- 8-1T	⅜	.3125	.2969	.2813	1⅝	#1 Morse	6½	3.35
7-16-1T	7/16	.3750	.3594	.3438	1⅝	#1 Morse	6½	3.75
1- 2-2T	½	.4375	.4219	.4063	1⅝	#2 Morse	7	4.25
5-16-2T	5/16	.2500	.2344	.2188	2⅛	#2 Morse	7½	4.85
5- 8-2T	⅝	.5625	.5469	.5313	2⅛	#2 Morse	7½	5.00
3- 4-2T	¾	.6875	.6719	.6563	2⅛	#2 Morse	7½	6.90
7- 8-3T	⅞	.8125	.7969	.7813	2⅝	#3 Morse	7½	8.50
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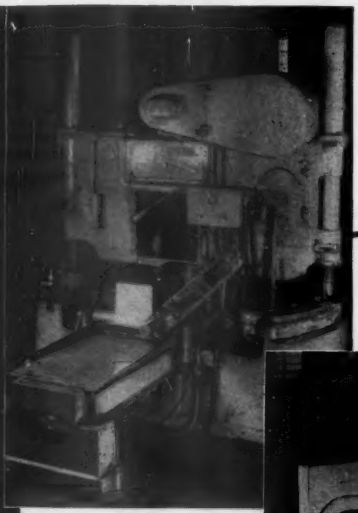

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